APPLIED Hydraulics & Pneumatics

APRIL 1960

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PLASTIC LINES

...can they meet your fluid power needs?

SEE CONTENTS PAGE 3

THE MAGAZINE OF FLUID POWER

PUBLISHED BY THE INDUSTRIAL PUBLISHING CORPORATION

Also in this issue: • **Selecting Cylinder Stroke Electrically**
• **How to Measure Air Content in Hydraulic Fluids**
• **Smooth Turnover with Rotary Actuators**

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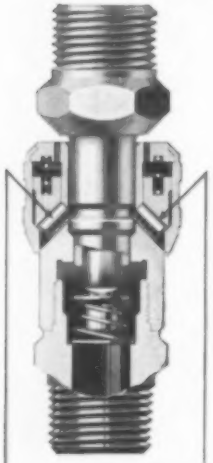

Tamper-Proof Socket Head — with leak-proof, minimum wear, locking device.

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- Instant automatic flow or shut-off.
- Factory assembled socket head cannot be readily damaged—or have component parts lost by casual tampering.
- Locking pins afford large area contact with Plug—reduces wear to a minimum.

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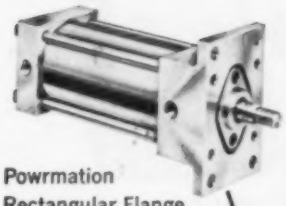

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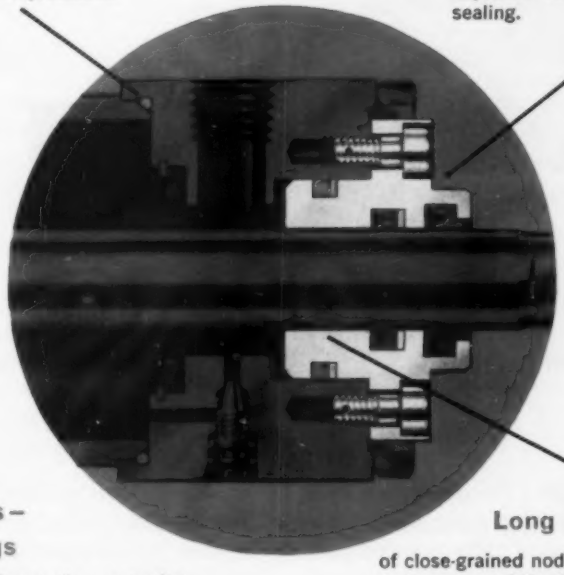
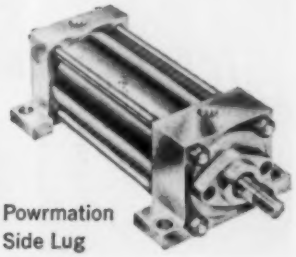
Rod End





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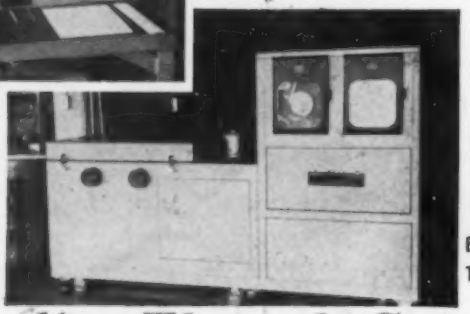

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Extra High Quality Through Creative Research

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ONLY MINNESOTA RUBBER CAN GIVE YOU REALLY COMPLETE DESIGN ENGINEERING AND PRODUCTION SERVICES

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APPLIED **Hydraulics & Pneumatics** ® VOLUME 13/NUMBER 4

APRIL 1960

THE MAGAZINE OF FLUID POWER

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CAPACITIES: Up to 80 G.P.M.
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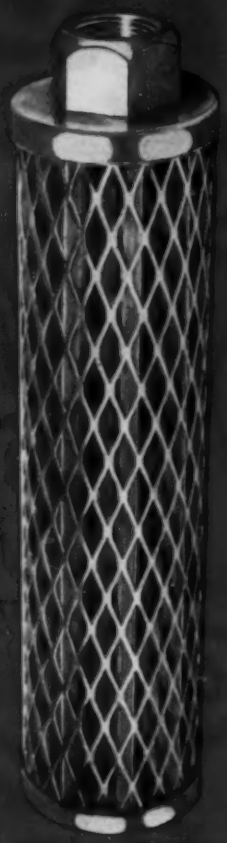
CONNECTIONS: Coupling—Male Nipple.
BY-PASS VALVE: Not available.



Bonded SUMP TYPE

CAPACITIES: 10—20—30—50 and 75 G.P.M.
PIPE SIZES: 1"—1¼"—1½"—2"—and 2½".
CONNECTIONS: Coupling—"O" Ring—Male Nipple.
BY-PASS VALVE: Available with or without.

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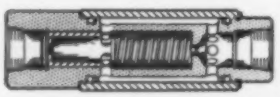

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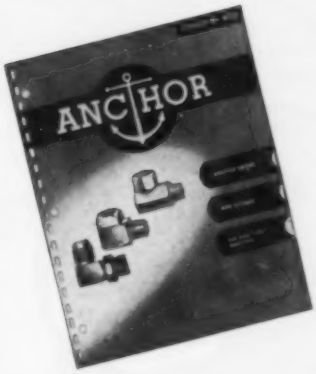
USEFUL LITERATURE

NEW ANCHOR CATALOG DESCRIBES ANCHOR'S EXPANDED LINE OF HYDRAULIC FITTINGS, UNIONS and ADAPTERS



This recently issued catalog is a revision of an earlier catalog describing Anchor's line of hydraulic fittings, unions and adapters, and now includes many new sizes and a general expansion of the line. It contains complete specifications, illustrations and drawings, including full information about the new items, plus other data and engineering information that will prove helpful to the engineer in designing fluid power transmission systems.

The Anchor line of Adapter Unions, Tees and Crosses is designed for use with Anchor Pressed-On or Reusable Coupling Hose Assemblies. They form a ground joint, leak-proof connection and eliminate one or more pipe thread joints at each connection. Assembly is made easier, especially in confined areas. Straining and twisting of hose in assembly is eliminated.

Positive, leak-proof seating, without danger of thread distortion or damage, is provided when Anchor SAE Straight Thread "O" Ring Boss Type Fittings are used. Straight, 45° and 90° adjustable elbows, a tee, service tee and a 90° check valve are available to provide a maximum degree of flexibility in making boss connections. Connections can be loosened and retightened any number of times without danger of leaks.

Several styles of Anchor Tube Nuts for tube diameters from ⅛" to 2" are illustrated.

Copies of the new Catalog No. 206 may be obtained by writing Anchor Coupling Co. Inc., 311 No. Fourth St., Libertyville, Illinois.

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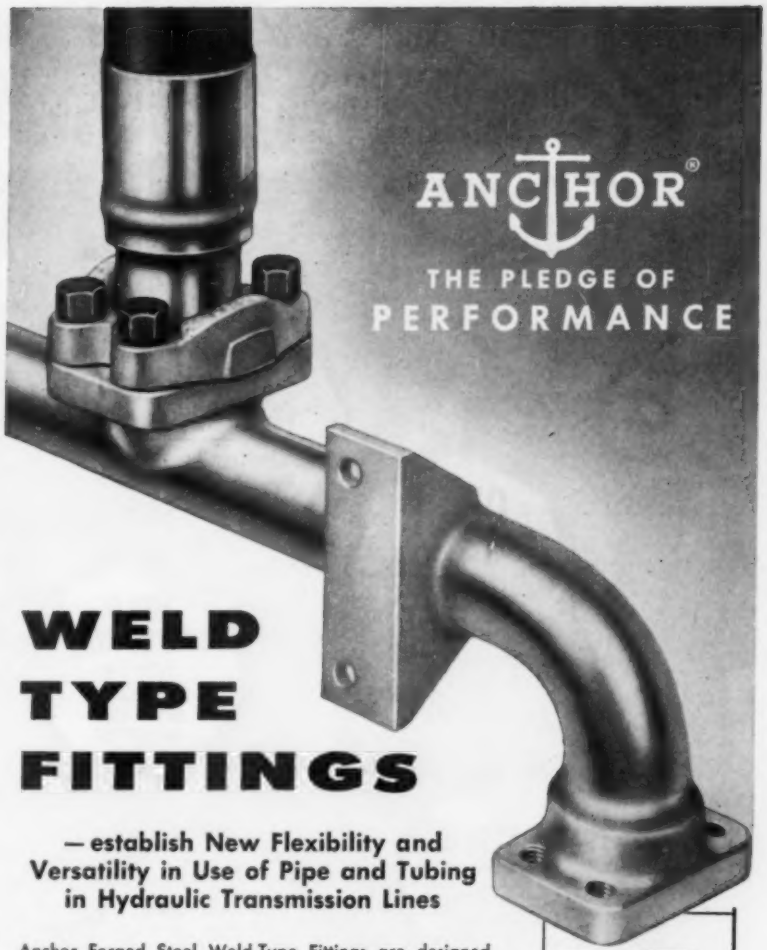


WELD TYPE FITTINGS

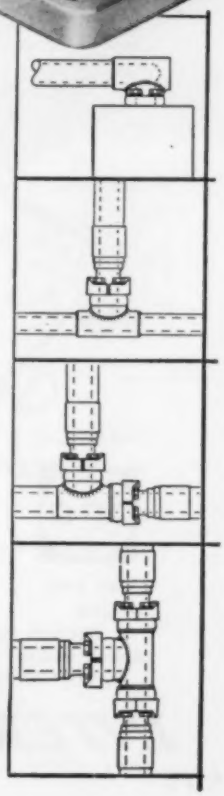
— establish New Flexibility and Versatility in Use of Pipe and Tubing in Hydraulic Transmission Lines

Anchor Forged Steel Weld-Type Fittings are designed especially for use with Anchor Split-Flange Clamp Halves and "O" Ring Flanged Head Couplings to create another Anchor Hydraulic "First."

They provide pipe and tubing assemblies with better flow characteristics. The need for pipe threads and pipe fittings, and their inherent problems, is eliminated.

Installation is extremely simple and dependable — Anchor Weld-Type Fittings are bolted securely to flange or port by four socket-head screws and an "O" Ring is employed to ensure a positive, leak-proof connection.

Anchor Weld-Type Fittings are available with drilled holes and "O" Ring Groove for bolting to valve or pump, or threaded holes without "O" Ring Groove for connection to Anchor Flanco Hose Assemblies by means of Anchor SAE 4-Bolt Split Flange Clamps. They are designed in straight, 90° elbow and tee styles for ends of pipe or tubing, and in saddle style for side positioning,— any number may be placed along the length of the assembly,—and in sizes for ¾" to 2½" pipe and for 1" to 2¾" tube.



Andy Anchor says:
"Don't delay writing for complete details and specifications.

ANCHOR COUPLING CO. INC.

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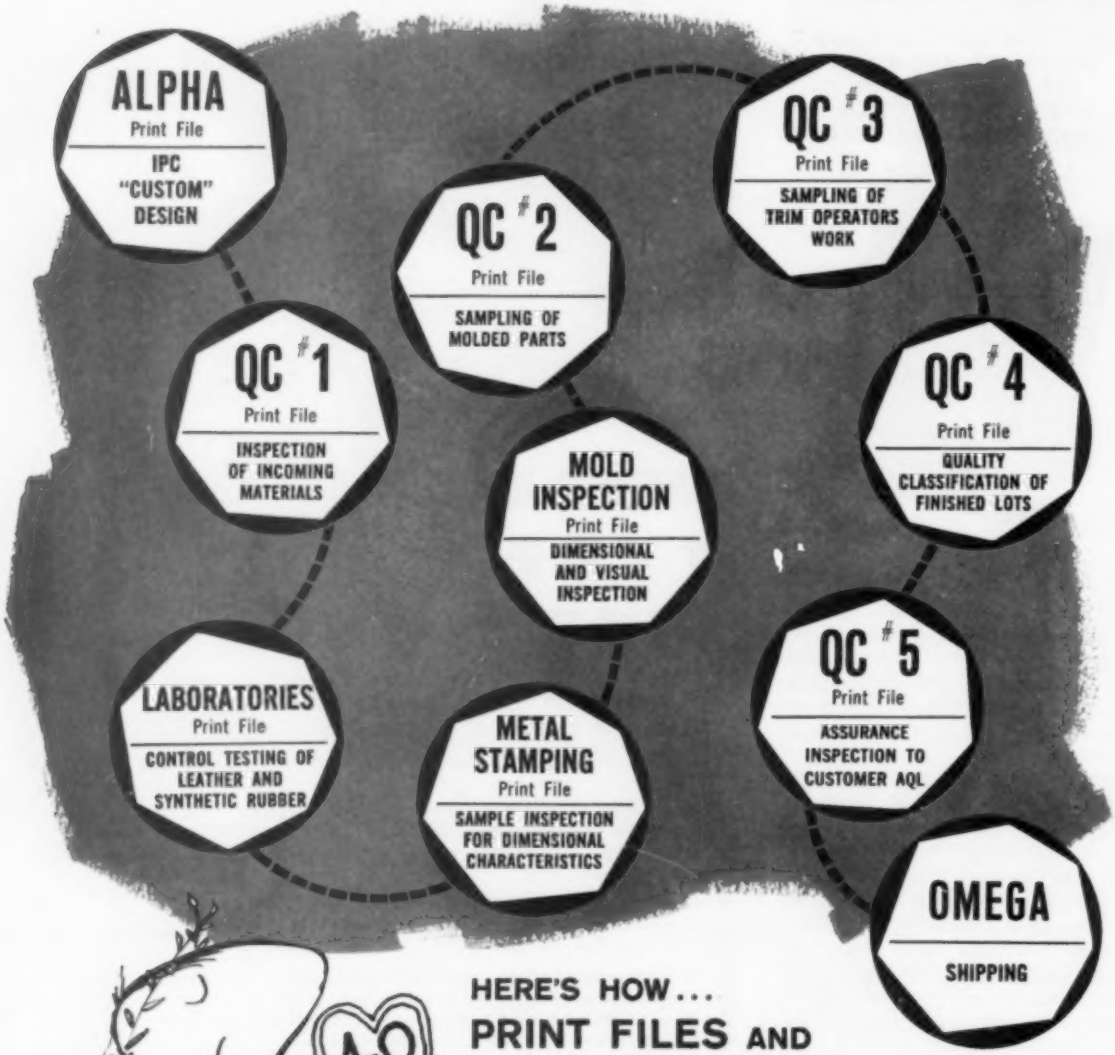

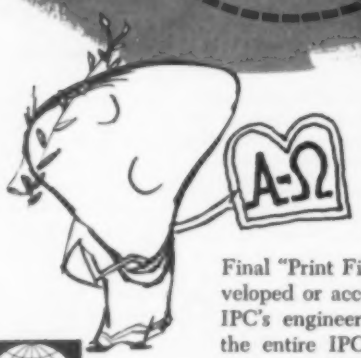

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Final "Print Files" for every product developed or accepted for manufacture by IPC's engineers are located throughout the entire IPC plant. These provide a positive, at-hand reference for product quality!

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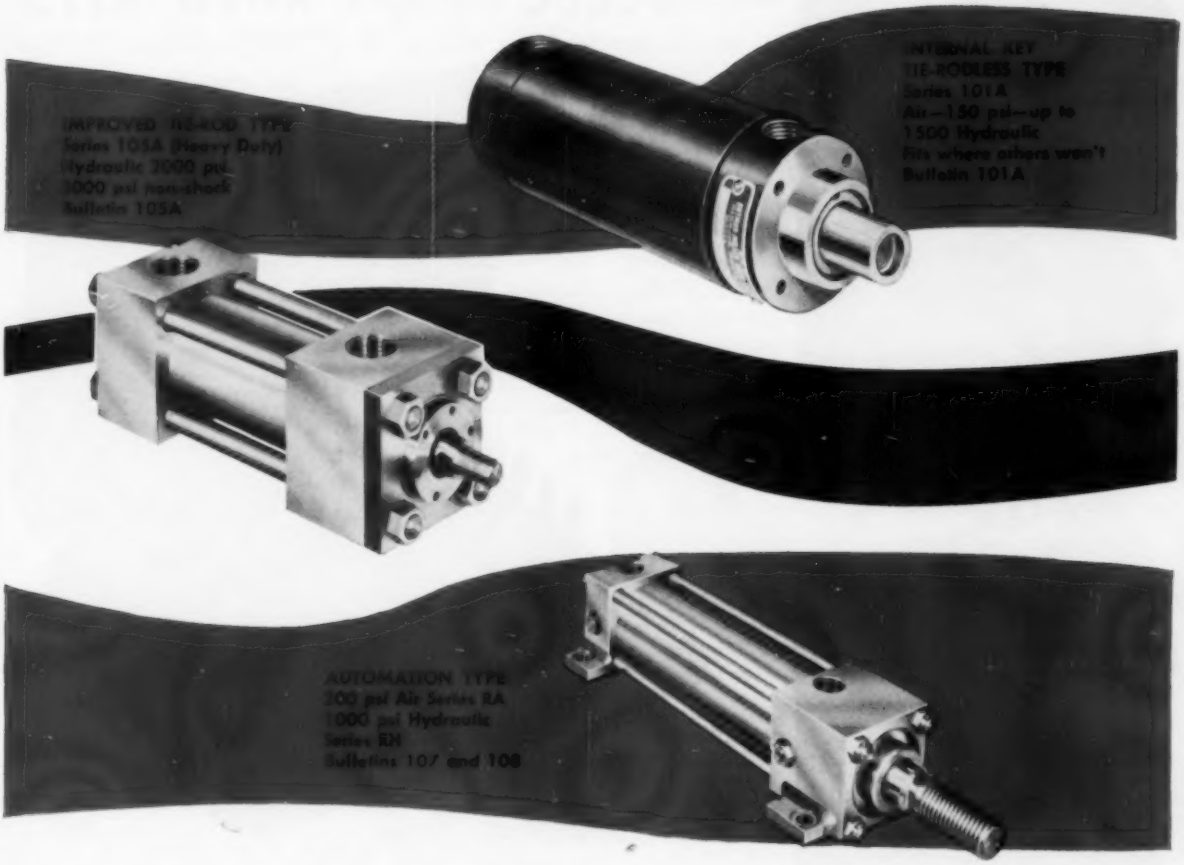
O-M Cylinders Hold Every Stroke to a Close Tolerance



all O-M Cylinders meet JIC standards

Regardless of the bore size, diameter of rod, length of rod travel, type of mounting and position in which they are mounted, O-M Cylinders operate with high reliability and precision with every stroke.

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. . . Fluid Power news

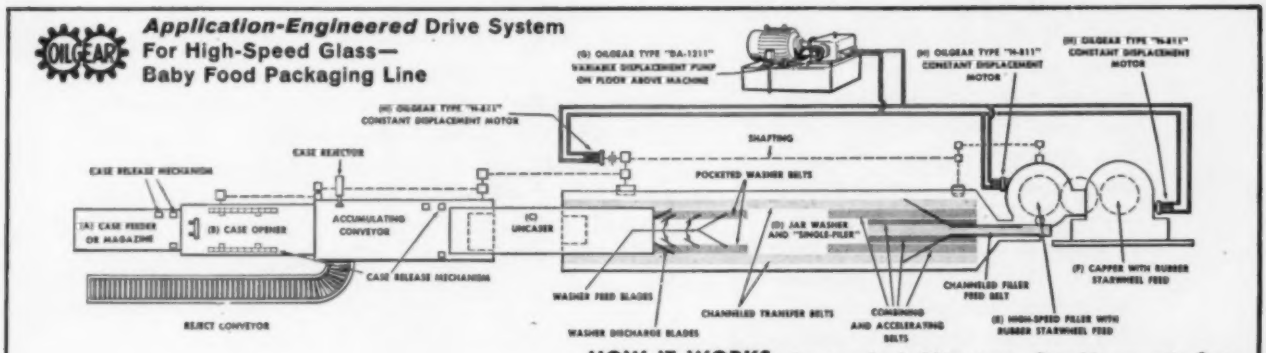
REPORT NO. 11,303 SPEED—COST "BREAK-THRU" FOR GLASS PACKAGING

From Oilgear Application-Engineering Files

HOW OILGEAR SYSTEMS *on Gerber's Integrated Glass Lines* BOOST OUTPUT—CUT COSTS

USER: *Gerber Products Company, Fremont, Michigan; Rochester, New York; Oakland, California*

DATA: To sharply reduce breakage, jam-ups, downtime, and labor costs in filling glass baby food jars at higher speeds, Gerber's Engineering Research Department developed the first fully integrated, high-speed machine for packaging foods in glass economically, under completely automatic control. *Drive Requirements for this multi-unit machine were outlined as follows:* 1. Complete synchronization of the seven integrated units through three drives—at the Uncaser, Filler, Capper. 2. Positive, precise, remote pneumatic control of operating speed that is instantly, infinitely variable from very slow to top speed while the machine is running. 3. Controlled acceleration and deceleration to prevent jars from tipping and jamming, eliminates spillage, reduces machine strain. 4. Compact, for maximum work area. 5. Independent operation of Filler and Capper drives to facilitate cleaning. 6. Trouble-free, dependable, long-life operation, immune to frequent sanitary washdowns, fully enclosed to prevent food contamination.



HOW IT WORKS. One man feeds 24-jar cases—flap side up—onto Case Feeder (A). Timing mechanism synchronizes delivery to Case Opener (B) where carton flaps are lifted out. Unopened flaps or inverted jars cause automatic case rejection. Normal cases proceed to Uncaser (C) where the case and divider panels are pushed down and away from the jars. Uncaser deposits jars on transverse-channeled conveyor platens. Blades slide jars from channeled platens into pocketed belts which hold jars inverted through Washer (D). Jars are plowed from washer belt pockets to transverse-channeled combining and accelerating belts—moving 350 to 400 jars per minute . . . are then "shuffled" into the "Single-Filer"—550 to 650 jars per minute on a channeled belt to Filler (E). Rubber starwheels minimize breakage in feeding the 25-pocket Girdler Filler (E), and 16 twin-head Anchor-Hocking rotary Capper (F) . . . both custom-built for Gerber with center-to-center jar spacing for positive, smooth glass transfer between units. Smooth synchronization, cushioned acceleration and deceleration provided by the Oilgear Drive and Control System, combined with no jar-to-jar contact make possible the almost noiseless higher speeds and virtual elimination of glass damage . . . for if even a single jar or bottle is broken in food or pharmaceutical operations, a complete and costly shutdown, cleanup and inspection of the packaging line by quality control personnel is required.

SOLUTION: An Oilgear "*Any-Speed*" Drive, consisting of a Type "DA-1211" variable displacement pump and three Type "H-811" constant displacement motors—powers all elements of "The Gerber Integrated Glass Lines" to *meet and exceed originally specified drive requirements.* For maximum work area around the "Glass Line," prevention of possible food contamination, and use of an economical electric motor, the Oilgear "*Power-Pak*" is located on a different floor of the building. A compact control panel located at the Filler enables the operator to start, stop, jog, and instantly vary speed of the entire machine through an infinite range while the machine is running—thereby obtaining maximum efficiency for the consistency of the food being filled. The drive system automatically synchronizes the speed of all seven machine units. Operating speed ranges from 550 to 650 jars per minute—depending entirely upon the products being filled . . . *an increase of up to 23% over former conventional glass packaging methods.*

GERBER REPORTS—"*The major advantages of this newly developed equipment are: less shock and scratching of jars, which reduces damage; substantially higher speeds: more thorough washing; lower maintenance cost and automatic control of all segments of the line.*"

Due to the smooth, cushioned application of power, even at higher speed, reduced glass damage and the resulting reduction in downtime, maintenance and labor costs with this Oilgear-powered, Gerber-designed machine, an expanded installation program of these "Integrated Glass Lines" is now under way at all Gerber plants.

"PLUS" features of this Oilgear Drive and Control System are: dual, automatic, built-in hydraulic and electric overload protection—stops the machine in event of jamming or malfunction . . . automatic hydro-dynamic braking . . . direct torque reading at the control panel . . . constant pressure and flood lubrication with continuous power fluid filtration . . . complete flexibility for location of drive and control components . . . fast, easy installation . . . standard drive and control components sealed against washdowns . . . lower power consumption—using only power in proportion to work performed. There are many more—but these alone should be sufficient proof why designers and builders of machinery are turning to Oilgear, and say . . .
"*for the lowest cost per year—it's OILGEAR!*"

For similar practical solutions to YOUR linear or rotary Controlled Motion problems, call the factory-trained Oilgear Application-Engineer in your vicinity. Or write, stating your specific requirements, directly to . . .

THE OILGEAR COMPANY

Application-Engineered Controlled Motion Systems

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FLUID POWER LINES

about hydraulics & pneumatics

FLUID POWER LINES . . . One of the most timely articles we've published is this month's feature on plastic lines. Drawing our information from manufacturers of nylon, polyethylene, and polyvinyl chloride tubing for fluid power systems, we found that some of their products have just been introduced in the past few months. Additions to these lines came on the market as this article was prepared.

Because plastic hose has wide applications, from low pressure instrumentation systems to garden hose, the companies producing it for pneumatic and hydraulic systems have obstacles to overcome. The designer who's back to watering his lawn with *rubber* hose after some sad experience with *plastic* may turn a deaf ear to the suggestion that he use plastic lines on his machines. What he must understand is that two plastics may look alike, feel alike, and smell alike, may both be called by one of the general names, but show up far different test results in the laboratory.

This is the *only* way to evaluate plastic hose. Some of the major builders of industrial and mobile equipment now have tests underway and prototype units in the field to learn how they can best use plastic lines in their applications.

BACK PRESSURE . . . Indian squaws didn't have to find out what caused it, they knew it was their papooses. But fluid power designs can have backpressure troubles from many sources. In his article on page 107, valve authority John Pippenger gives design pointers on how to avoid it.

AIR IN OIL . . . Designers of even the simplest hydraulic systems realize that they must have some way of bleeding off air which gets into the system. In servo systems which depend on oil stiffness for performance, sponginess caused by air affects performance even more. From Glasgow's Mechanical Engineering Research Laboratory, Donald Firth gives data showing air effects and describes equipment to measure it. His article is on page 88.

PRESSURE RATE . . . An interesting design to increase force linearly is the one worked out by Haskel's Ed Lauren and described in *Controlling Pressure Rate for Stress Testing*. Used on a sewer pipe tester, it has an electric motor drive to adjust relief valve setting. A more sophisticated version of this system is used on a tangent bender to maintain proper tension on the work as it is being formed. (AH&P June 1958). In that application an electronic system senses strain in the metal, compares it to yield point. A small motor on the relief valve adjusts accordingly.

PUMPS FROM BEARINGS . . . Design of the slipper pump described on page 73 goes back about sixty years when Professor Kingsbury of New Hampshire State College invented a thrust bearing with a .002 coefficient of friction. One of the first uses was to support the long vertical shafts of water-driven turbine generators at Niagara Falls. The idea is also being applied to radial bearings for centerless grinder shafts. This article shows how the design was adapted to a vane pump.

Circle 111 →

NO MATTER WHAT YOU'RE COOKING UP . . . *Chances are there is a ROSS valve ready!*

Ross is the air valve line with the largest selection and latest advancements.
Solenoid, hand, foot, cam and air operated valves in both line and base mount models, to serve straightway, 3-way and 4-way functions. Auxiliary and special valves too.
Write for digest catalog.

ROSS OPERATING VALVE COMPANY

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Vogt

DROP FORGED STEEL VALVES and FITTINGS

Modern die casting machine operation involves the use of standard hydraulic oils as well as special non-inflammable oils which must be safely and positively controlled at pressures from 800 pounds up to 4000 pounds per square inch.

Vogt drop forged steel valves, fittings, flanges and unions are unsurpassed for these rigorous duties and are standard equipment on the leading makes of die casting machines.

Consult Catalog F-10 for the complete line of Forged Steel Valves, Fittings and Flanges.

"FIRST CHOICE OF THE LEADING MAKERS OF DIE CASTING MACHINES"

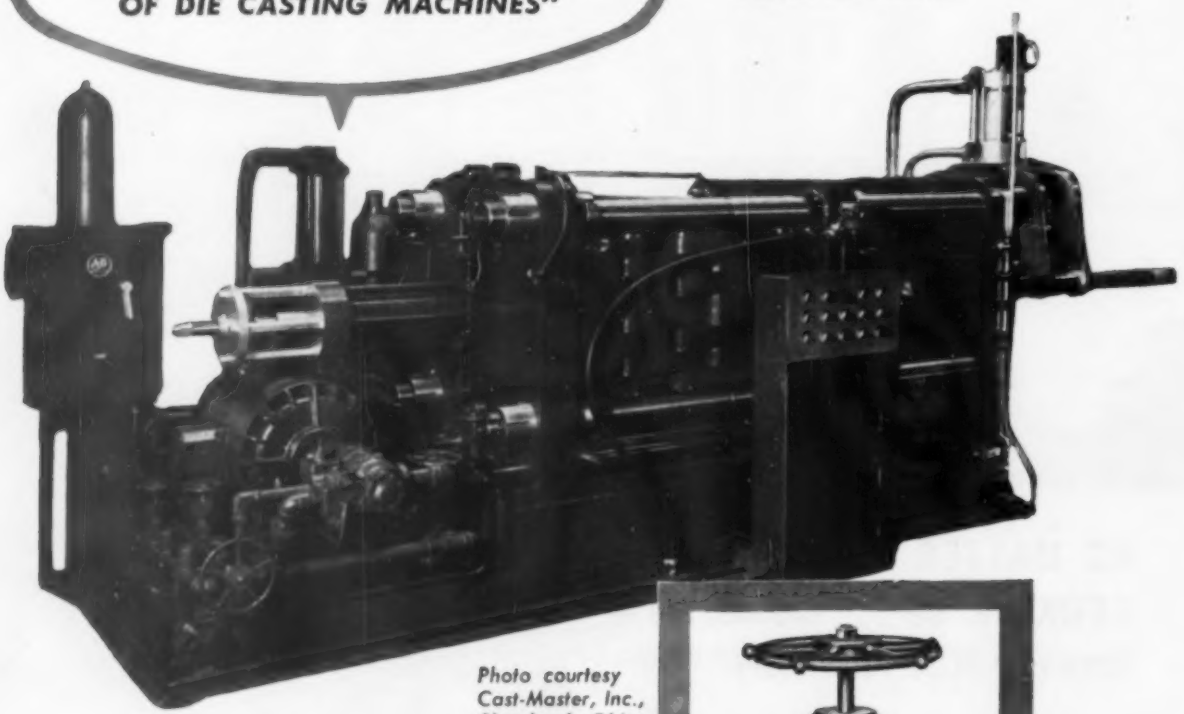

Photo courtesy Cast-Master, Inc., Cleveland, Ohio

HENRY VOGT MACHINE CO.
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Aeroquip PUSH-PULL Hydraulic Couplings Connect and Disconnect Fluid-Carrying Lines

QUICKLY and EASILY

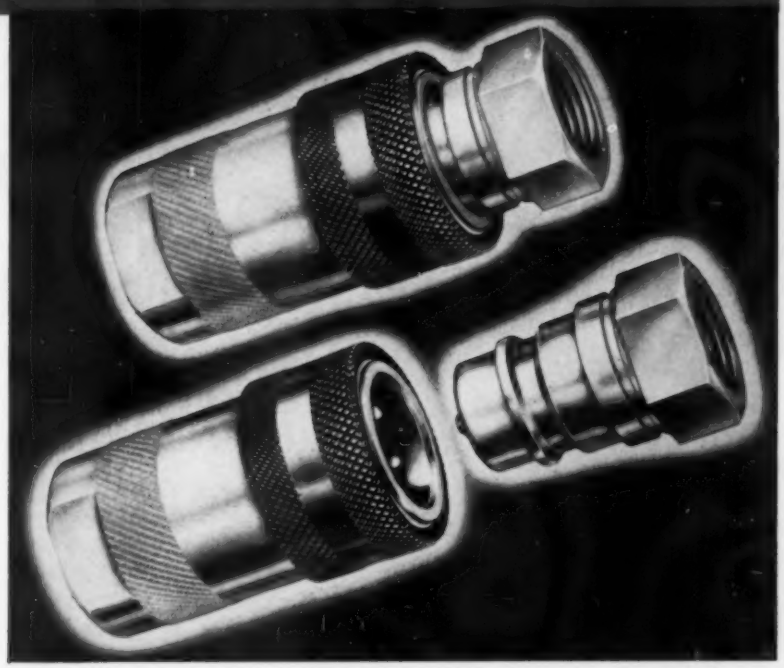
AVAILABLE IN TWO THREAD TYPES FOR INDUSTRIAL APPLICATIONS

5600 Series

For N.P.T.F. pipe thread connection in ¼" ⅜", ½", ¾" and 1" sizes.

5606 Series

For all S.A.E. straight thread boss (O-ring seal) connections up through 1" tube sizes.



- **Quick Connection and Disconnection**
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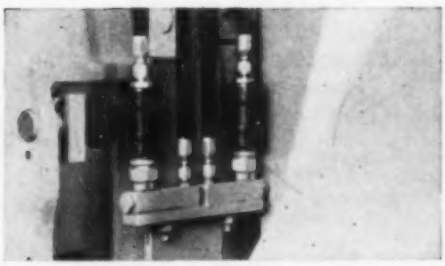
- **For Working Pressures Up to 3000 psi.**
- **Simple, Rugged Components**



Aeroquip PUSH-PULL Couplings on hydraulic lift truck.

The new Aeroquip PUSH-PULL Coupling is designed for quick, easy connection of hydraulic lines. It features a simplified poppet valve seal that gives long, leakproof service life. The coupling is constructed to protect against entry of dirt into the hydraulic system. Where connect-under-pressure feature is desirable, the 5650 Series PUSH-PULL Coupling is available.

Complete design information on the Aeroquip PUSH-PULL Coupling series is available. Fill in and mail the coupon below for your copy.

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Please send me your bulletin on PUSH-PULL Hydraulic Couplings for industrial applications.

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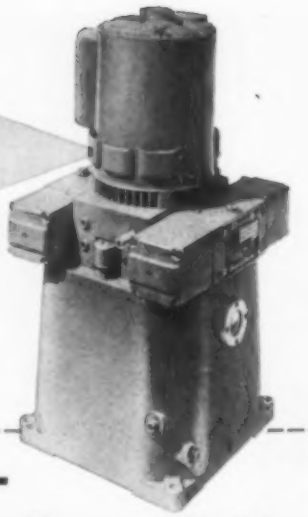
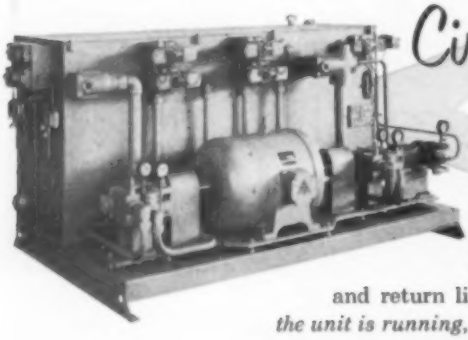
CircuitPak



Low-cost hydraulic power! The CircuitPak prices hydraulic power competitively with air power, for clamping, indexing, pressing, drilling, welding, etc. Get the precise control and pressures you need, with CircuitPak.

From Brown & Sharpe—

Double A Hydraulic Power Units

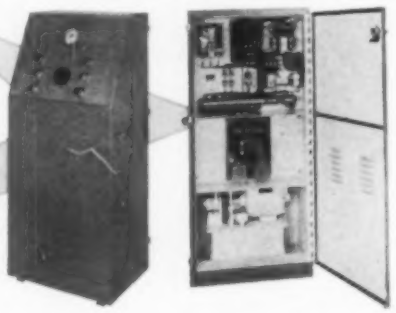


CircuitMaster

The unique L-shaped CircuitMaster design cuts external piping 40% or more, eliminates separate panels and manifolds. Every component is easily reached. Fluid from individual drain and return lines may be observed *while the unit is running*, for faster trouble-shooting.

Electro-Hydraulic
CONSOLES

Double A builds complete hydraulic-power and electric-control packages, providing one-stop shopping for the equipment builder.



Take advantage of Double A hydraulic developments. Contact your nearest Double A hydraulic distributor. Or write to **Double A Products Co.**, a subsidiary of Brown & Sharpe Mfg. Co., Manchester, Michigan.

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HYDRAULICS DIVISION

GEAR, VANE & CENTRIFUGAL PUMPS
DOUBLE A VALVES
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PROGRESS IN PRECISION FOR OVER 125 YEARS

GET COMPLETE INFORMATION
on Double A hydraulic power units
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the power unit bulletins

Circle **26** on Time-Saver Card

LETTERS — to the editor

Address your letters to: Editor, APPLIED HYDRAULICS & PNEUMATICS MAGAZINE, 812 Huron Rd., Cleveland 15, Ohio.

More about Temperature-Compensated Flow Controls

TO THE EDITOR:

The letter in the January 1960 issue asking for information on temperature-compensated flow control valves reminds us of a project of ours, shelved because we lacked information on that very thing. Please name the present sources for these valves.

ROGER R. HAUSE
President
Hause Valve Co.
Montpelier, Ohio

Names of two manufacturers have been sent.

Credit is due . . . Howard Ledeen, Ledeen Manufacturing Co., El Monte, Calif. for technical assistance on cylinder design in the February article "Hydraulic Pogo Stick Debeaches Landing Ship." By mistake his name was omitted from the article.

Compressed Air Saw

TO THE EDITOR:

We have had the inquiry of whether there is such a thing as a pneumatic chain saw. Do you know of such an item on the market?

J. A. G. COWPER
Cowper Co. Ltd.
Montreal, Canada

We're not aware of a manufacturer of this equipment. Perhaps one of our readers can suggest a source.

By error . . . products of Tru-Flate, Inc. of Oakland, Calif. were not included in the January 1960 Designers Guide issue. These should have been specified in the selection chart, "Couplings, Quick Connect."

THE KEY TO A DEPENDABLE SYSTEM!

Eastman
HYDRAULIC HOSE ASSEMBLIES

EASTMAN designs complete hydraulic operation for SCHRAMM Rotadrill

Valves mounted in three convenient banks for each outrigger, forward and reverse rotation of motor, slow down speed, rapid down speed and for breakout cylinder.

The cooperation of EASTMAN Engineering was enlisted in making the operation of this truck-mounted Schramm Rotadrill *completely hydraulic.*

Hydraulic power is delivered through EASTMAN Hydraulic Hose Assemblies to:

1. Three-Speed Reversible Rotation Head: Standard speeds—44, 65 and 120 r.p.m. with 26,500 inch pounds torque. 2. Cylinders controlling down feed, rapid feed and slow feed. 3. Controls for raising and lowering of mast. 4. Breakout Cylinder. 5. Hydraulic Winch and Hook. 6. Three Outriggers.

Dependable field service is assured through EASTMAN Two-Wire Braid High Pressure Hose with Permanently Attached Couplings providing a bond stronger than the hose itself.

Efficient power delivery through the extensive, multiple circuits of this rock-drilling rig is obtained through EASTMAN designed permanently attached hose assemblies which insure longer life and lower cost.

ENGINEERED FOR ENGINEERS BY ENGINEERS

Let EASTMAN Engineering assist you in planning the initial layout of your hydraulic system—for most efficient power delivery and lowest cost.

PERMANENTLY ATTACHED COUPLINGS
for 1, 2, and 3 wire braid rubber cover hose

REUSABLE COUPLINGS
for fabric cover hose

REUSABLE COUPLINGS
for rubber cover hose

CLAMP COUPLINGS
for 1, 2, and 3 wire braid rubber cover hose

Write today for Bulletin 100 and 200 on EASTMAN High, Medium and Low Pressure Hydraulic Hose Assemblies.

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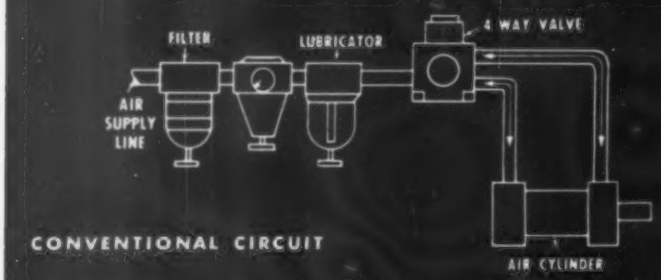
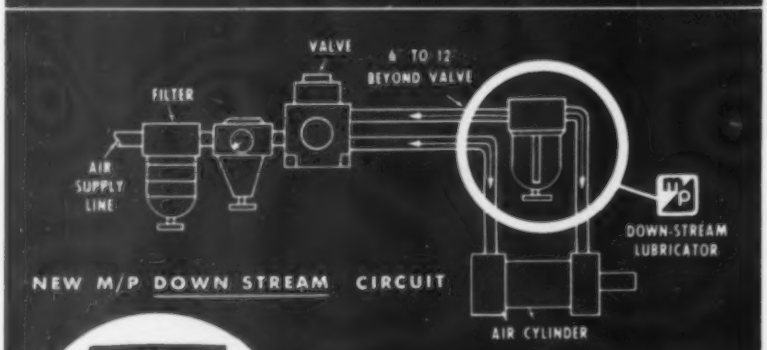
NEW mp CONCEPT
OF AIR CYLINDER LUBRICATION



CONVENTIONAL CIRCUIT



NEW M/P DOWN STREAM CIRCUIT

DESIGNED SPECIFICALLY FOR AIR CYLINDERS

With a conventional circuit the air cylinder may not be lubricated because oil introduced by the lubricator is trapped in the valve and exhausted to atmosphere. Any small amount of oil that works through the valve may also be exhausted when the cylinder is reversed.

Now . . . M/P has developed a new concept of air cylinder lubrication. The new Lubricator (Model M204) installed in the *Down-Stream Circuit* assures lubrication of both the control valve and the cylinder.

Contact your local representative or M/P for a detailed brochure.

HYDRO-JECTOR
Automatic drain valve that can be installed easily in the bottom drain port of any compressed air filter, drain leg or surge tank.

SHATTER-GUARD
A new feature which makes the M/P *Visi-Bowl* as safe as a metal bowl. Available on all M/P Filters, Lubricators and *Hydro-Jectors*.

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FLUID POWER FORUM

Each month APPLIED HYDRAULICS & PNEUMATICS surveys readers for their experiences and opinions in fluid power design.

- *Have you been troubled by shock? How have you reduced it?—accumulators, decompression, improved deceleration valves, special directional valves or circuitry?*

A large triplex pump we have delivers 3000-psi water to a 3-inch distribution header serving a number of buildings. About 100 ft. from the pump, the header rises vertically 15 ft. then continues horizontally at a right angle to its intial direction. Immediately after the 15-ft. riser, the header vibrates so much that it causes the building to vibrate too. We have tried pneumatic accumulators at the pump, bracing the piping at the riser, and insulating the piping from the hangers with rubber in the vicinity of the riser. None of these methods has worked to our satisfaction.

FRANK STEREN
Engineer
Raybestos Manhattan, Inc.
Passaic, New Jersey

I don't believe anyone is entirely free of the shock problem. We have used accumulators and deceleration valves with good sucess and still don't feel we have a fixed answer that could cope with all the varied conditions. In some cases we find that due to the nature of the product, we do not need any of the above equipment. Thus, every job must stand on its own merits.

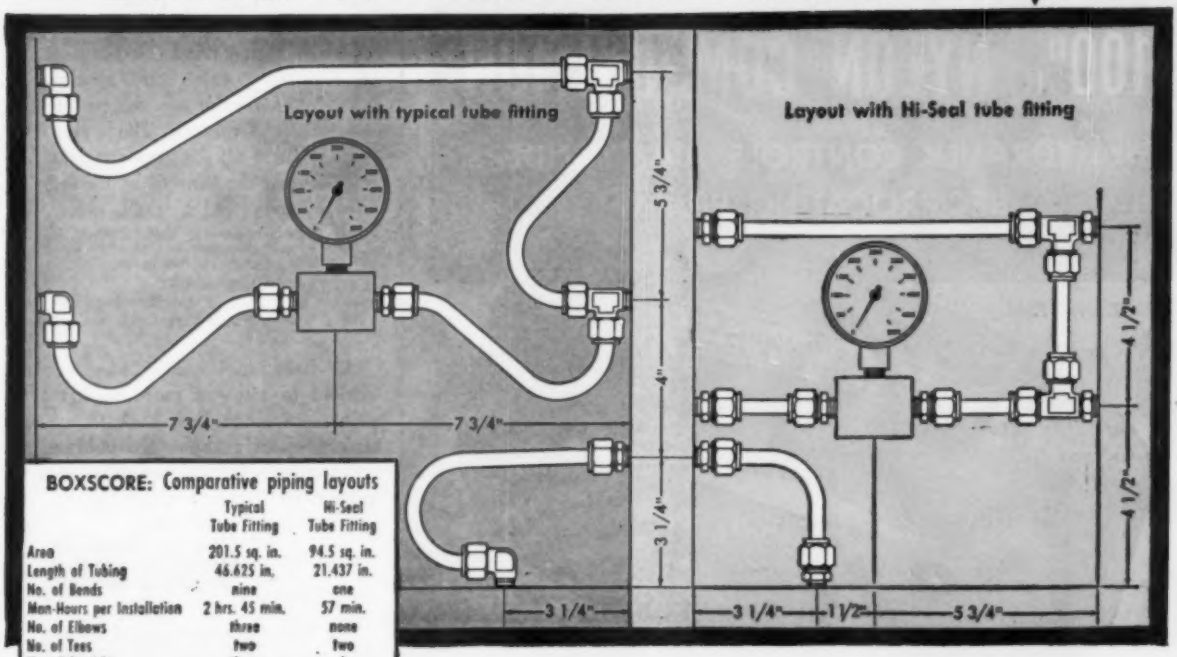
J. W. TAYLOR
Mechanical Engineer
Garrett Oil Tools
Longview, Texas

We have reduced shock by special snubbers on actuators and by programmed shutoff on servo valves. We have to reverse direction in .04 seconds and snub in

Continued on page 20

IMPERIAL *Engineering and Data File*

ENGINEERED TUBE FITTINGS — VALVES — TUBING TOOLS



BOXSCORE: Comparative piping layouts

	Typical Tube Fitting	Hi-Seal Tube Fitting
Area	201.5 sq. in.	94.5 sq. in.
Length of Tubing	46.625 in.	21.437 in.
No. of Bends	nine	one
Man-Hours per Installation	2 hrs. 45 min.	57 min.
No. of Elbows	three	none
No. of Tees	two	two
No. of Straights	three	six

How Hi-Seal saves space—cuts costs

. . . makes possible reductions up to 50% in required piping area . . . up to 66⅔% in installation time!

Imperial Hi-Seal tube fittings open up economical *new piping design concepts* for instrumentation, hydraulic circuits, and other tubing installations. Hi-Seal makes possible far more compact layouts than can be made with conventional fittings — in addition, it brings *new ease and speed* to joint making and utmost reliability.

These design considerations are illustrated in the tubing layouts above. The diagrams show how Hi-Seal actually eliminated nine tube bends . . . saved more than one-half on tubing needed. Total layout area required by Hi-Seal is only 94.5 sq. in., compared to 201.5 sq. in., when an ordinary fitting is used. And 189% *more* manhours were required to tube up the circuit with a typical fitting.

Several key fitting design factors account for Hi-Seal piping economies: (1) Hi-Seal makes a positive butt joint — no need to spring tubing; (2) speedy, foolproof assembly — it is impossible for the fitting to be assembled with the alloy steel sleeve in reverse position; (3) there is no danger of over-torqueing . . . when threads on body of fitting are covered, a pressure-tight seal has been made, a visual assurance of a correct joint; (4) under tests, Hi-Seal fittings have withstood pressure of 4,000 psi at conditions of −320° F. to over 700° F.

with *no* leakage; (5) Hi-Seal fittings can be disconnected and reconnected as often as desired.

Complete line — Hi-Seal fittings are available in brass, steel, stainless steel. Also furnished in Titanium, Tantalum and other metals. Steel fitting supplied with cadmium plate or black phosphate finish. Conform to J.I.C., A.S.M.E. and A.S.A. standards. In sizes for ⅛" to 1½" O.D. tubing. Furnished with Long Dryseal pipe threads or straight thread port seal.

Write for Catalog No. 3108

IMPERIAL

THE IMPERIAL BRASS MFG. CO.
6300 W. Howard St., Chicago 48, Ill.

In Canada: 18 Hook Ave., Toronto, Ont.

New high-pressure valves assemble directly to tubing — eliminate additional fittings

A revolutionary new line of Imperial needle valves designed for working pressures up to 5,000 psi., and temperatures to 450° F., employs Hi-Seal tubing connections.

Write for Catalog No. 3108

CONTACT YOUR INDUSTRIAL DISTRIBUTOR OR WRITE TO:

THE IMPERIAL BRASS MFG. CO.
Dept. AH-40, 6300 W. Howard St.,
Chicago 48, Ill.

Please rush me Catalog No. 3108

Name .....
Title .....
Company .....
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City .....Zone .....State .....

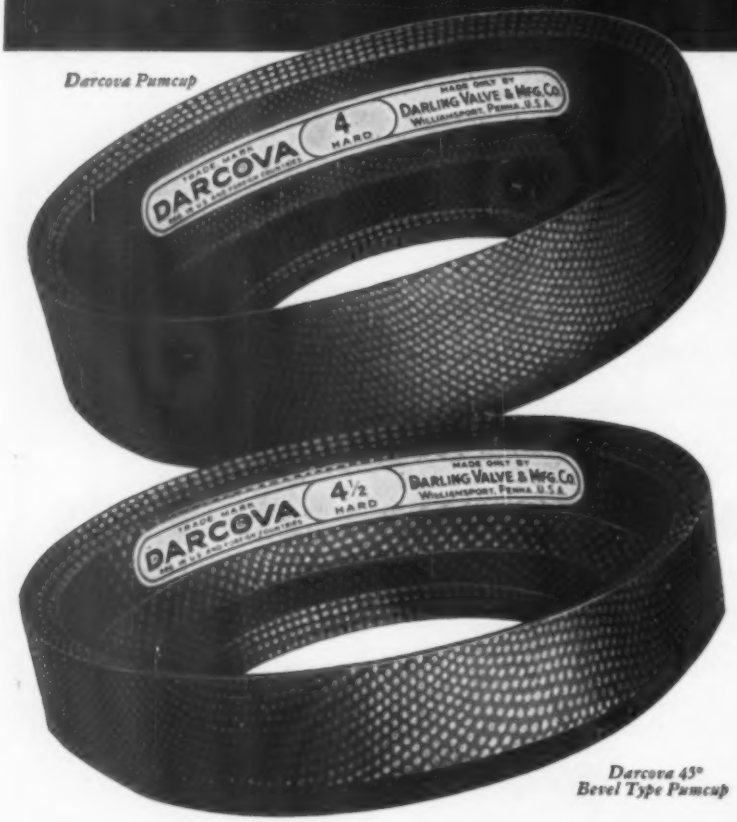
DARCOVA PUMCUPS

now available with

100% NYLON COMPOSITION

for HYDRAULIC CONTROLS, AIR CYLINDERS, RECIPROCATING PUMPS

Darcova Pumcup



Darcova 45°
Bevel Type Pumcup

DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

Write for helpful data Bulletin No. 5903.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP

TRADE MARK
PUMCUPS

Circle **34** on Time-Saver Card

FORUM

.020 to .030 in. of stroke. The answer was a programmed, reverse direction control (electronic) on the servo valve and special nylon poppet valve on the piston end of the actuators. The nylon poppet closed off the pressure port and damped the flow of hydraulic fluid by means of a small, razor-blade type groove in the poppet.

B. P. MOORE
Consultant
Stavid Engineering, Inc.
North Plainfield, N. J.

A directional valve was reworked to allow a more positive volume of oil to flow back to the tank to satisfy the cycle volume requirements for the pressures required.

R. F. FISKE
Supervisor Engineer
General Electric Co.
Hendersonville, N. C.

We had one problem of shock that comes to mind. In a large earthmoving machine, a 65-gallon pump supplied oil at 1000 psi. The pump was mounted on a hinged plate and belt driven. Shock caused the pump to shake on its mountings. The problem was solved by using a long piece of hose as a shock absorber and eliminating discharge pipe.

P. NOONAN
Chief Engineer
Richardson Road Machine
Saskatoon, Canada

We have reduced shock by direct operating, ball poppet relief valves.

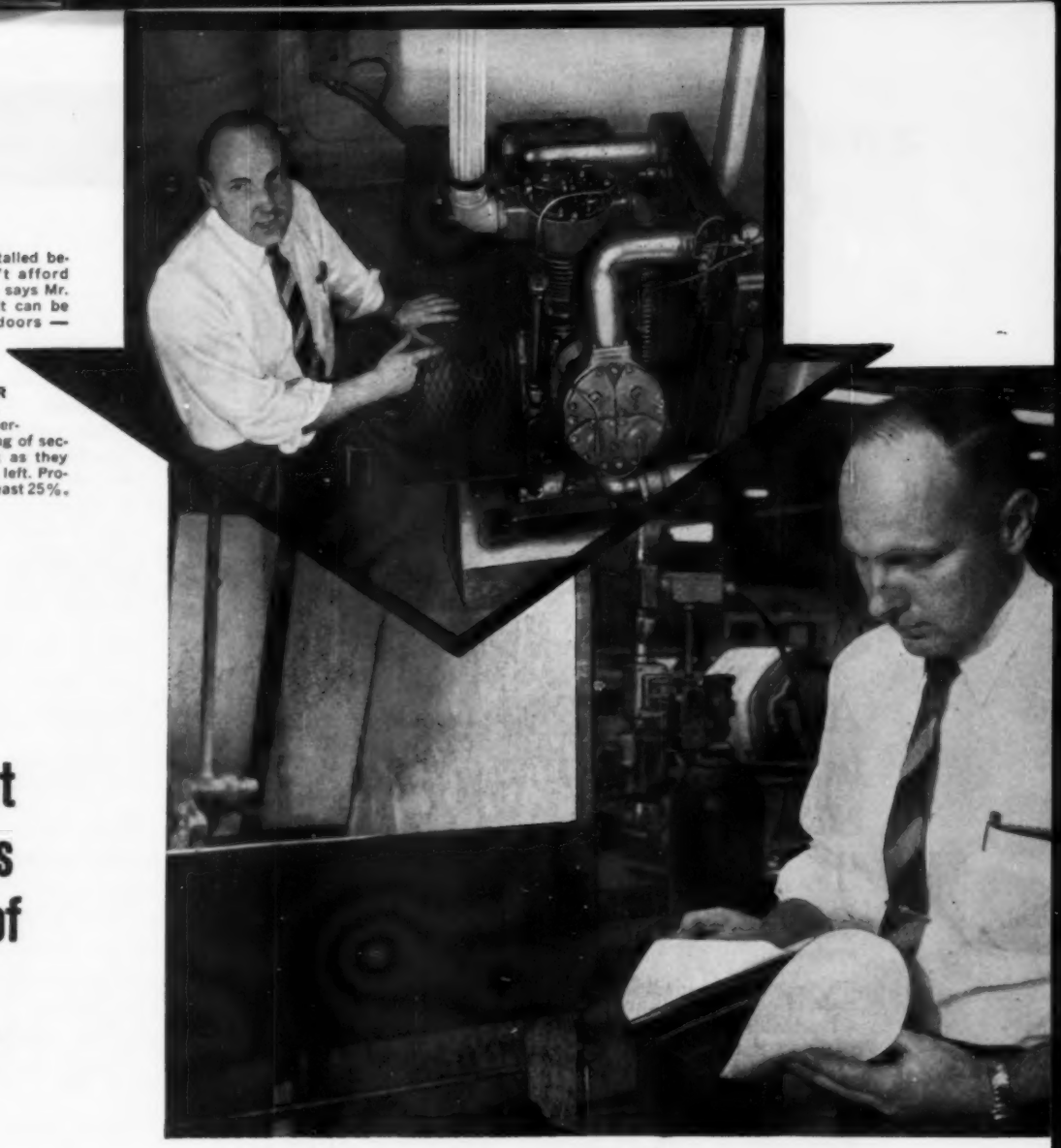
C. WELLS
Engineer
American Industries
Bristol, Pa.

We have shock, especially in water systems where a combination of rupture disks and fixed orifices are used to protect the high pressure lines. A special relief is first triggered and the ultimate safety depends on the blow out disk.

A. L. LICCARDI,
Engineer
Baldwin, Lima, Hamilton
New York, N. Y.

Continued on page 22

Circle **74** →



LE ROI 50S2 was installed because Bowes couldn't afford compressor downtime, says Mr. LaFara. Air-cooled unit can be used indoors or outdoors — needs no plumbing.

FINISHED TIRE REPAIR SECTION is inspected. Compressed air now permits automatic spraying of sections with liquid latex as they pass through booth at left. Production increased at least 25%.

This plant minimizes the risk of "no air - no work" with a

LE ROI 50HP STATIONARY COMPRESSOR

A dependable compressor headed the list of critical needs when Bowes Seal Fast Corp., of Indianapolis, Ind., merged two plants under one roof. A Le Roi 50S2 two-stage compressor provides this vital dependability . . . and all the compressed air needed to produce over 2000 various items for the upkeep of cars, tires, and tubes.

James S. LaFara, Plant Manager, reports that the Le Roi unit delivers 210 cfm at 125 psi . . . operates 75% to 80% of 8- to 16-hour production days, five days a week, and supplies almost 100% of all the compressed air needed. Down-time, he adds, is at a minimum, and maintenance costs are below those of two smaller compressors which the Le Roi replaced, and which now serve only as standby units.

Look what this Le Roi 50S2 does! It provides air to spray tire-repair sections (boots) and tubeless-tire repair plugs with a mixture of liquid soap and water. The unit powers latex spraying machines, and blows scraps from tube-patch cutting machines. Other uses include air for lead moulding equipment, nut-driving units, cleaning vents on chemical filling machines, and for the plant's fire-protection system.

Are you looking for a "dependable" compressor? Check the complete line of Westinghouse unit-type and Le Roi stationary air compressors — from ½ to 100 hp. Contact your Le Roi distributor, or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

SC-98

LE ROI STATIONARY COMPRESSORS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

EXTRA SAFETY EXTRA SERVICE fulflo VALVES

ALL STEEL
for *positive* AUTOMATIC PRESSURE CONTROL

The combination of FULFLO Valve design with ALL-STEEL construction is outstanding when you're looking for safe, trouble-free and quiet operation in any hydraulic system.

FULFLO design offers shear-closing action to eliminate chattering; sliding piston for full flow opening; easy adjustment within the pressure range or change of the pressure range.

ALL-STEEL construction adds extra safety, maximum protection against fire or mechanical damage demanded by hydraulic designers and users . . . to the advantages proved by literally thousands of FULFLO all-brass or stainless trimmed valves.

Whatever your requirements . . . for O.E.M. use or replacement service . . . there's a FULFLO Valve designed just right, built right and priced right.

- **Screw or flange models . . . to 500 lbs. . . . pipe sizes to 3"**
- **Steel, cast or brass bodies . . . brass, steel or stainless trim**
- **Just 6 springs for complete range of pressures**
- **Fast shipment of standards . . . specials to your requirements**

Need a "special"?

FULFLO can engineer a special valve to your most exacting specifications . . . and deliver faster than you may think possible.

FOR COMPLETE INFORMATION,
request a copy of 1960 FULFLO Valves Mechanical Data Book.

FULFLO **THE FULFLO SPECIALTIES CO., INC.**
415 Fancy Avenue Blanchester, Ohio

Circle **45** on Time-Saver Card

FORUM

- *How do you decide when to use a heat exchanger on your equipment? How do you determine its size? What problems have you had with heat exchangers?*

I determine when to use a heat exchanger by the type of circuit required and the type of duty the circuit is expected to encounter. Bypassing over a relief valve for long periods of time would, in most instances, mean that a heat exchanger would be required. I normally determine the size required by estimating the heat added to the system (sum of horsepower loss of system over a period of time) and then using heat exchanger selection tables that are available from manufacturers.

Because of the lack of water available for cooling in this area, there has been considerable interest in water-to-air heat exchangers for both mobile and industrial applications.

WM. O. IOTT
Denison Engineering Div.
Tulsa, Oklahoma

Our experience with heat exchangers is very limited. In general our valve positions use oil at low rates, between about 1 gpm and 6 gpm with about 3 gpm as an average. We have only once run into a heating problem which eventually forced us to install an oil cooler. One of our U. S. suppliers of pumps has been kind enough to supply us with a basis to enable us to calculate approximately the temperature rise under given flow and pressure conditions for a given tank surface area. This at least does enable us to determine whether heating troubles are likely to occur. In view of the small quantities of oil available, the problem of deciding the size of oil cooler is not difficult as it generally resolves itself into the "smallest size available."

H. C. DAWSON
General Manager
Evershed-Powertronic Ltd.
Toronto, Canada

▼▼▼

Norgren MANUAL-DRAIN AIR-LINE FILTERS

maintenance is this quick... this easy!

6 Top of filter remains connected to air line.

5 Filter element is held on by baffle plate.

4 Baffle plate is easily unscrewed by hand.

3 Clamp ring has quick-opening spring clip.

2 Filter bowl is held on by clamp ring.

1 Drain cock is easily turned by hand to empty liquid.

No tools required!
Fewer parts to handle!

Norgren Manual-Drain Air-Line Filters can be quickly and easily disassembled to remove the filter element for cleaning. No tools are required. There are only 4 loose parts to handle, and reassembly is simple... a quick, easy job for anyone.

As a result, a Norgren manual-drain air-line filter is faster and easier to service than any other make of filter. This adds up to a big yearly saving for you in maintenance time and money.

Norgren Filters give you top performance

in removing damaging solids and liquids from an air line. Available with transparent or metal bowls. ¼", ⅜", ½", ¾", 1" pipe sizes.

For further information on the money-saving features of Norgren manual-drain air-line filters or Norgren automatic-drain air-line filters, call your nearby Norgren representative listed in your telephone directory—
or WRITE FOR DESCRIPTIVE LITERATURE

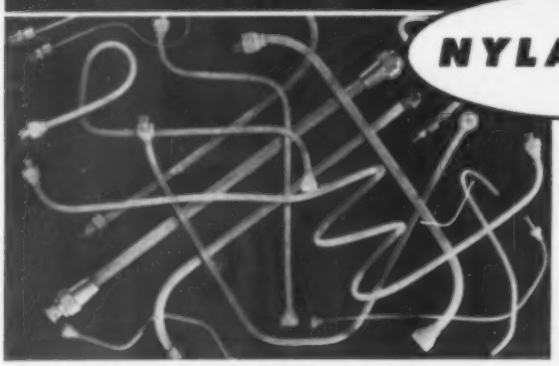
Compare Norgren with other makes of air line filters!

MAKE	NORGREN	A	B	C	D	E
Loose Parts to Disassemble	4	9	16	13	6	12
Tools Required for Maintenance	NONE	Wrench	Wrench & Screwdriver	Screwdriver	Wrench	Wrench & Pliers
Tool Operations Required	NONE	2	10	16	2	4

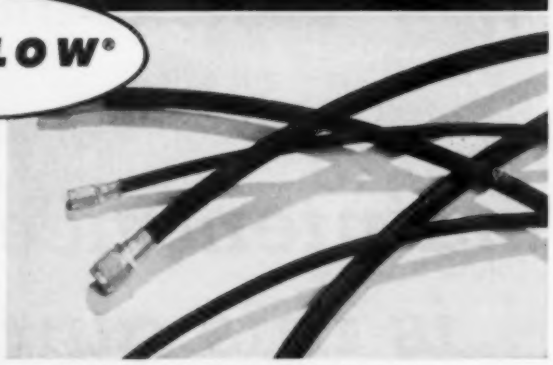
C. A. NORGREN CO.

FOUNDED IN 1926 — 3402 SOUTH ELATI STREET, ENGLEWOOD, COLORADO

STRONGER • LONGER FLEX LIFE • LIGHTER • MORE ECONOMICAL



NYLAFLOW®



PRESSURE TUBING

. . . a specially processed flexible polyamide tubing engineered for conveying air, liquids and gases.

Outstanding Performance Characteristics

High pressure rating at low cost. High resistance to flex and vibrational fatigue. Mechanically strong—resists abrasion and impact. Corrosion resistant, unaffected by oils, hydraulic fluids including non-flammable synthetic hydraulic oils, carbonic acid, alkalies and most solvents. Odorless, tasteless, non-toxic, non-corrosive, fungus resistant. Will not embrittle in storage. Serves wide temperature range: as low as −100°F., up to +225°F.

Ease of Installation

Use with standard metallic flare and flareless fittings. Flexibility can eliminate pre-bending, flexible couplings, intermediate fittings. Easily cut and flared. Can be installed and fastened around existing equipment. Quickly bent with clips or permanently prebent with heat. Requires no deburring. Light (1/7 weight of copper), easy to handle.

Where to use Nylaflow Pressure Tubing

The superior characteristics provided by Nylaflow have proved applicable to the following:

- Lubrication lines • Hydraulic lines • Pneumatic lines
- Oil or fuel lines • Beverage and syrup lines
- Vacuum lines • Caustic or solvent lines

FLEXIBLE PRESSURE HOSE

. . . an all-synthetic polyamide tube reinforced with high tensile strength yarn for outstanding flex resistance.

Outstanding Performance Characteristics

High pressure rating with small O.D. to I.D. ratio. Excellent resistance to fatigue when flexed and pressure pulsed. Lightweight—approx. 1/5 that of rubber hose. Mechanically strong—resists abrasion and impact. Unaffected by flammable and non-flammable hydraulic fluids. Excellent resistance to caustics and nearly all organic solvents. Low freon permeability. Odorless, non-toxic, non-corrosive, fungus resistant. Will not embrittle in storage. Retains excellent flexibility and toughness in temperatures as low as −80°F. Can operate constantly in temperatures up to 200°F., intermittently in temperatures as high as 300°F.

Ease of Installation

Can be permanently heat-formed to small, stress-free bend radii. Available in long continuous lengths. Form stable—will not sag or fall into surrounding equipment.

Uses for Nylaflow Pressure Hose

Nylaflow pressure hose has performance and cost advantages for the following type applications:

- Hydraulic lines • Fuel and oil lines • Freon lines
- High pressure CO_2 lines • High pressure lubrication lines
- Hot water lines (150° and below)
- High pressure pneumatic lines • Solvent or hot paint lines

THE DESIGN AND PERFORMANCE CAPABILITIES OF NYLAFLOW PRESSURE TUBING AND NYLAFLOW FLEXIBLE PRESSURE HOSE ARE OUTLINED IN BULLETINS AVAILABLE FROM THE POLYMER CORPORATION OF PA., READING 7, PA. WRITE FOR YOUR COPY TODAY.

POLYPENCO

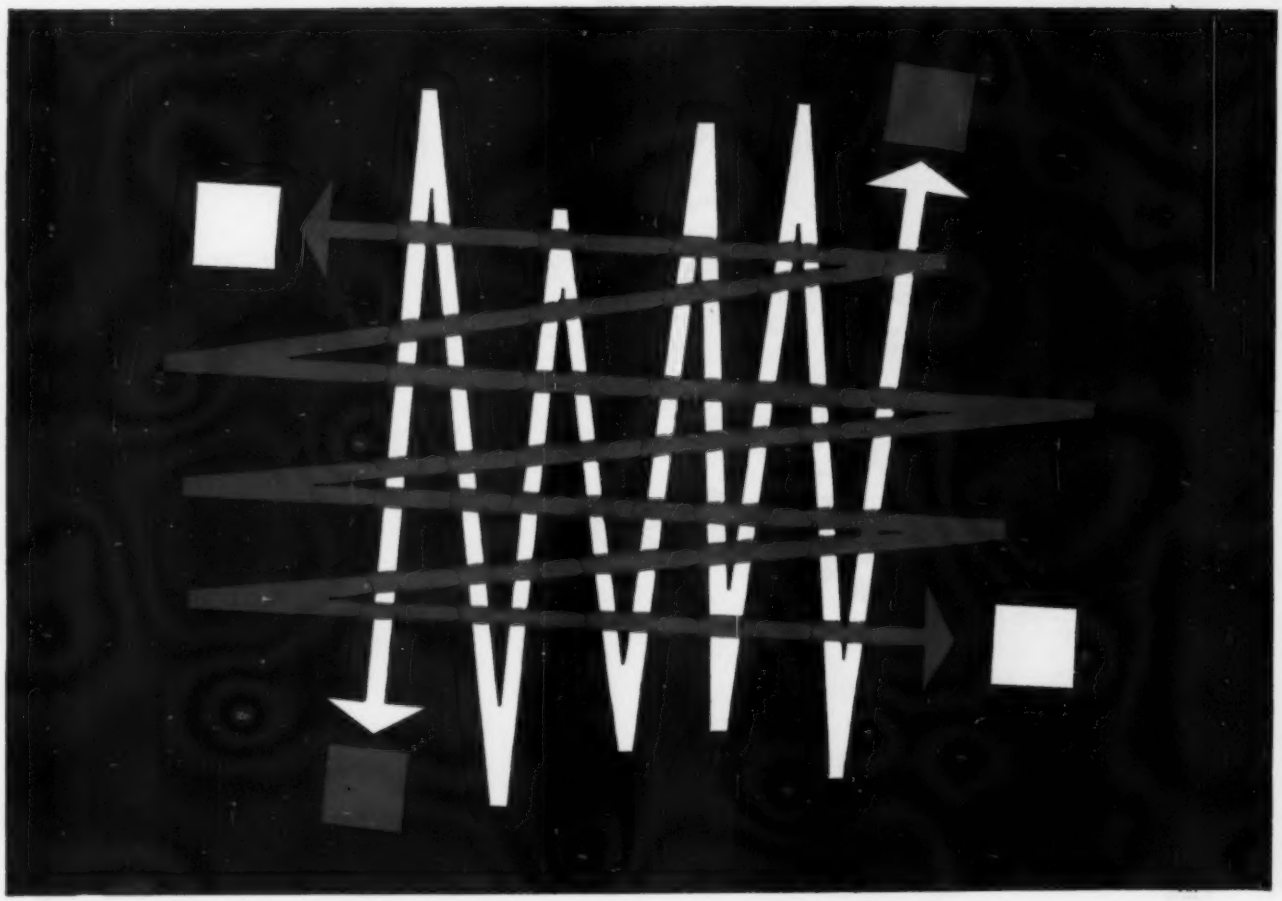
The Polymer Corporation of Penna.
Reading, Pa.

Export: Polypenco, Inc., Reading, Penna., U.S.A.

TYPE	SHORT TIME BURST RATING*	NYLAFLOW TUBING STOCK SIZES AVAILABLE					
T	1000 psi	Outside Dia.	⅛"	5/16"	¼"	5/16"	⅜"
		Inside Dia.	.090"	.138"	.190"	.242"	.295"
		Minimum Bend Radius	⅛"	1"	1¼"	2"	3"
		Standard Coil Length	500 ft.	350 ft.	200 ft.	150 ft.	100 ft.
H	2500 psi	Outside Dia.	⅛"	5/16"	¼"	5/16"	⅜"
		Inside Dia.	.070"	.110"	.150"	.180"	.225"
		Minimum Bend Radius†	½"	⅝"	1¼"	2"	2½"
		Standard Coil Length	500 ft.	350 ft.	200 ft.	150 ft.	100 ft.

*Conditions such as length of time under pressure, temperature and humidity affect actual burst pressures. Although testing for a particular purpose is recommended, a safety factor of 4 to 1 can be considered good engineering practice for many applications.

HOSE PART NUMBER	NYLAFLOW HOSE SELECTOR										
	802-A	803-A	804-A	805-A	806-A	808-A	503-A	504-A	505-A	506-A	508-A
Inside Dia., size (in.) & tolerance	⅛" ± .006	3/16" ± .008	¼" ± .010	5/16" ± .012	⅜" ± .015	½" ± .018	3/16" ± .008	¼" ± .010	5/16" ± .012	⅜" ± .015	½" ± .018
Outside Dia. size (in.)	.215	.312	.425	.465	.560	.805	.290	.385	.435	.535	.675
Max. Operating Pressure (psi)	2000	2000	2000	2000	2000	2000	1250	1250	1250	1250	1250
Minimum Proof Pressure (psi)	4000	4000	4000	4000	4000	4000	2500	2500	2500	2500	2500
Minimum Burst Strength (psi)	8000	8000	8000	8000	8000	8000	5000	5000	5000	5000	5000
Max. Elongation at 3000 psi (%)	±2	±2	±2	±2	±2	±2	±2	±2	±2	±2	±2
Minimum Bend Radius (in.)	1.75	2.25	2.5	3.0	3.5	4.5	2.25	2.5	3.0	3.5	4.5
Weight (lbs. /100 feet)	1.07	2.29	3.97	4.35	6.60	14	1.87	2.78	3.17	5.18	8



LINEAR MOVEMENT precise and controlled,

powerful or gentle, cushioned or abrupt, fast or slow,

variable or constant, can only

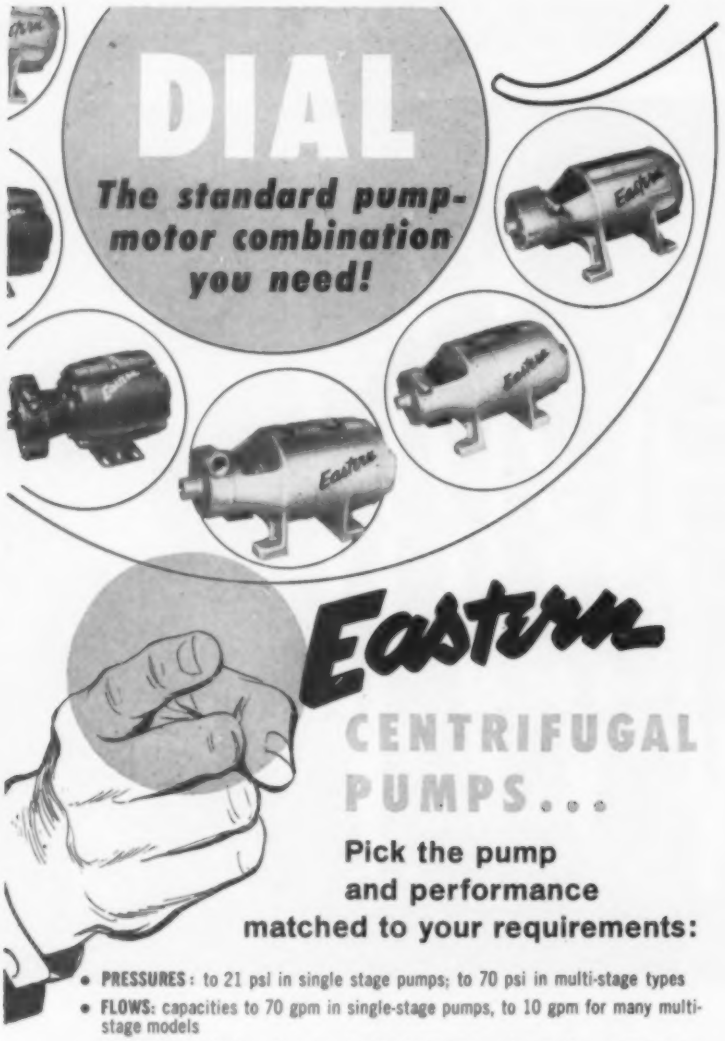
be achieved by hydraulics.

Ask us at KEELAVITE

We at Keelavite are a team of experts engaged SOLELY in the application of hydraulic power

KEELAVITE
Hydraulics

KEELAVITE HYDRAULICS LTD • ALLESLEY • COVENTRY • ENGLAND • TEL: MERIDEN 441


DIAL
The standard pump-motor combination you need!
Eastern
CENTRIFUGAL PUMPS . . .
Pick the pump and performance matched to your requirements:
• PRESSURES: to 21 psi in single stage pumps; to 70 psi in multi-stage types
• FLOWS: capacities to 70 gpm in single-stage pumps, to 10 gpm for many multi-stage models
• MOTORS: standard motors for 115/230-volts 60 cycles 1 phase (other electrical characteristics available). Power range from ⅛ to 1½ H.P.
• ENCLOSURES: drip-proof, totally enclosed, and explosion-proof ball-bearing frames
• DRIVES: all models available in belt or coupling drive with ball-bearing-equipped stands. Space-saving close-coupled pumps most rugged and popular—but many pedestal models also available
• SEALS: a variety of rotary seals and stuffing boxes, to fit every application
• METALS: your option of cast iron, bronze, stainless steel, Monel, Cast Iron, Hastelloy "C"
• INSTALLATIONS: a wide range of transfer, recirculation, feed, boost, and filter-pumping applications
one or more is just right for you!
Eastern
INDUSTRIAL CENTRIFUGAL PUMPS
TO FIND OUT: write for the brand-new Centrifugal Pump Catalog — Bulletin 130. Here are all the models — and a wealth of basic engineering data besides. For a complete review of Eastern positive displacement pumps, write for Bulletin 220. And Eastern Bulletin 810 is your guide to a broad line of high-speed gear pumps and hydraulic motors.
EASTERN INDUSTRIES, INCORPORATED
EASTERN INDUSTRIES PUMP DIVISION
100 Skiff Street Hamden, Conn.
WEST COAST OFFICE
4203 Spencer St., Torrance, Calif.
Circle 39 on Time-Saver Card

FUTURE EVENTS

April 12
HIGH PRESSURE HYDRAULICS SEMINAR
Milwaukee School of Engineering
Milwaukee, Wisc.
For additional information contact Russell W. Henke

April 21
1ST MEETING
FLUID POWER SOCIETY
Detroit, Mich.
for more information, see "Briefs," page 28

April 21-28
ASTME TOOL SHOW & ANNUAL CONVENTION
Detroit, Mich.

April 25-26
ASME MAINTENANCE & PLANT ENGINEERING CONFERENCE
Chase-Park Plaza
St. Louis, Mo.

April 25-29
1ST INTERNATIONAL COMPRESSED AIR & HYDRAULICS EXHIBITION
Empire Hall
London, England
concurrent with the 2nd European Fluid Power Conference

May 9-11
SPRING MEETING, NATIONAL FLUID POWER ASSOCIATION
Grand Hotel
Pt. Clear, Alabama

May 11-14
MEETING, FLUID CONTROLS INSTITUTE, INC.
The Greenbrier
White Sulphur Springs, W. Va.

May 23-26
DESIGN ENGINEERING SHOW
Coliseum
New York, N. Y.

September 7-15
2ND COLISEUM MACHINERY SHOW
Chicago Coliseum
Chicago, Illinois

October 20-21
16TH NATIONAL CONFERENCE INDUSTRIAL HYDRAULICS
Sherman Hotel
Chicago, Illinois
for additional information contact Leroy A. Wickstrom, Illinois Institute of Technology, Chicago 16, Ill.

FEATURED IN CONTROL SYSTEMS OF MISSILE PROGRAM!

New FLOW CONTROL VALVES

pressure compensated

From **RIVETT**

Rivett Hydraulic Flow Control Valves are *now* being introduced to the trade after four years of thorough field testing in advanced applications for both government and industry. These valves may be used as ordinary "meter in," "meter out," or "bleed off" types of compensated flow control valves by keeping the bypass port plugged in the subplate, and piping the "inlet" and "outlet" ports as desired. This usage means excess oil is spilled over a relief valve so pump is always at full horsepower.

On some meter-in circuits, with the "bypass" port piped to tank, the "inlet" and "outlet" can be piped as above, but any excess oil fed to the valve will flow to tank. As long as the fluid motor or cylinder is working at less pressure than system relief valve setting, the Rivett 3-port flow control will maintain oil flow to the work as set, the bypass port will flow excess oil to tank at the work pressure, and therefore the pump is using horsepower only at the rate determined by work requirements.

FEATURES

1
Knife edge orifice positively assures consistently uniform low flow; and minimizes change of flow when change of fluid temperature occurs.

2
No drain connection required because special pressure balanced Teflon seals are used.

3
Maximum flow capacities up to 125 G.P.M. in 1½" size are standard.

4
Valves are usable as two port and three port models.

5
Vernier knob has provision for safety lock wiring.

6
Valves are available with return free-flow check.

RIVETT, INC.

Dept. AH-4, Brighton 35, Boston, Mass.

The Better You Know Hydraulics — The Better You Like

RIVETT

BRIEFS

about fluid power

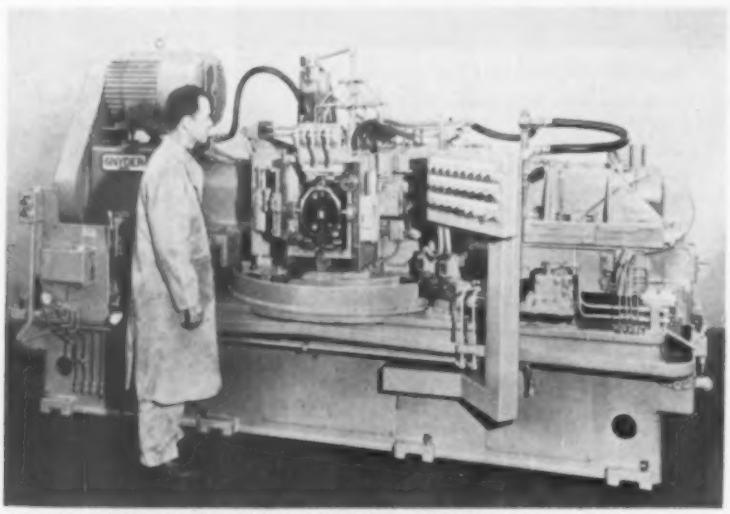
Fluid Power Society Formed

A new technical organization has been formed to bring together men interested in various phases of hydraulics and pneumatics. Membership is open to men concerned with research and development, design, application, installation, and maintenance of fluid power systems and components. Instructors of fluid power courses are also invited to join. Membership will come from many fields including industrial, aircraft, and mobile equipment.

• **Membership is open**—Purpose of the new society is to further development and use of fluid power, and to help members learn more about it. It has been formed by the National fluid Power Association and the Industrial Hydraulics Training Association. The NFPA, formed in 1953, is a trade association of hydraulic and pneumatic component manufacturers. The IHTA was organized in 1957 in Detroit by a group of instructors of industrial hydraulics. These two groups have worked for the past year to organize the Fluid Power Society. They felt the need for an organization outside the established technical societies which have shown little interest in fluid power. Their programs have been too broad to include much of value to the engineer and technician looking for hydraulic and pneumatic information.

• **First meetings in Detroit, Milwaukee**—First meeting of the Fluid Power Society will be in Detroit on April 22 when members of the Industrial Hydraulics Training Association will be chartered as Chapter No. 1. Those not affiliated with IHTA are invited to attend. Chapter No. 2 is being formed in Milwaukee. Other chapters are also in development. Plans are for local units in all principal cities of the U.S. and Canada by the end of 1961.

Further information is available from Barrett Rogers, Executive Vice President, National Fluid Power Association, 5595 North Hollywood Ave., Milwaukee 17, Wisconsin. ▼▼▼



THIS MACHINE MILLS, DRILLS, CHAMFERS, AND REAMS malleable iron automotive differential carriers. Hydraulic cross-feed heads are used in all three stations. The parts are loaded into a fixture on the index table in station one, where air cylinders control clamps. Air-actuated, wedge-type jacks support the parts at the fixture. Electrical push-buttons control the machine. It is made by Snyder Corp., Detroit. The machine works 85 pieces per hour.

Conference Session to Cover Extreme Hydraulic Pressures

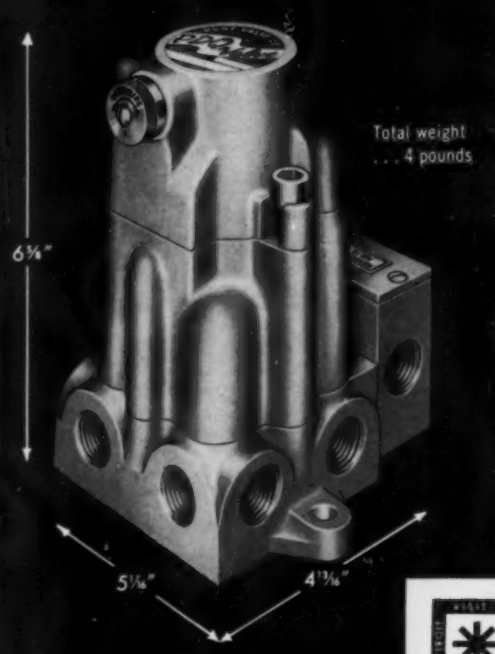
The hydraulics session of the Design Engineering Conference has been set for 9:30 A.M., Tuesday, May 24. Edward Brown, engineering director of Vickers' Machinery Hydraulics Div., will speak on "Hydraulic Components for Extreme Service." Richard L. Leslie, supervisor of the Vickers fluids laboratory, will give "Fluids and Seals for Extreme Service." Session co-chairmen are Edward M. Greer, Greer Hydraulics, Inc., Jamaica, N.Y., and John Farris,

Continued on page 30

Circle 59 →

THE HUNT PDQ

has Faster Response Time and Greater Capacity than Air Valves—*4 Times Its Weight and Twice Its Size!*



Total weight . . . 4 pounds

You asked for a light, compact valve

Here is a full 1/2" air valve at **4 pounds.** It will flow 335 c.f.m. with 100 p.s.i.g. initial pressure to atmosphere. It measures 6-1/2" high by 5-1/16" wide by 4-13/16" deep.

You asked for speed and capacity

Here is what the Hunt PDQ is capable of. Response time to fill a 140 cubic inch vessel to 90 p.s.i.g. with an initial pressure source of 100 p.s.i.g. is .113 seconds. (6.8 electrical cycles.) To exhaust the same vessel from 90 to 10 p.s.i.g. is .195 seconds. (11.7 electrical cycles.)

The short-stroke pilot actuates a compact, full-orifice poppet-spindle amazingly fast . . . renders traditional air valves obsolete.

The Hunt 1/2" PDQ air valve is designed to do the things you've wanted a valve to do since the advent of automation. Write us today.

N. C. HUNT, PRESIDENT

HUNT VALVE COMPANY · SALEM, OHIO, U. S. A.

- ☑ Accessibility
- ☑ Simplicity
- ☑ Speed and Capacity
- ☐ Price and Quality

The Hunt PDQ valve tops them all in every class.

Next month . . .
the PRICE and QUALITY story.

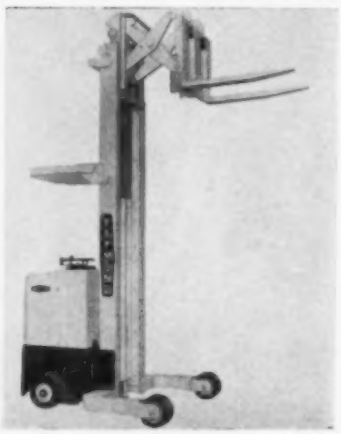
HUNT HVC ***Quick-As-Wink*** AIR & HYDRAULIC CONTROL VALVES

HIGH
TEMPERATURES?
COMPOUNDS
EFFECTIVE TO
+550° F
TECHNICAL MEMO ON LINEAR COMPOUNDS
8251-70—8250-85—8252-90
. . . outstanding for O-Rings, V-Rings and U-Cups.
• truly effective sealing at temperatures to +550°F
• suitable for use with a wide variety of fluids, including oils, fuels, water and diverse chemicals
• good resistance to compression set and wear
FLUIDS COMPATIBLE WITH THESE COMPOUNDS
Acetone • Acetylene Tetrabromide • Air • Amyl Alcohol
Aniline • Arochlor 1248 • Benzine • Carbon Disulfide • Carbon Tetrachloride • Chloroform • Cyclohexane • Dowtherm A
Styrene • Sulfuric Acid • Toluene • Benzol • Dry Chlorine Gas
Ethyl Alcohol • Ethylene Dichloride • Ethylene Glycol • Gasoline
GE 81406 • Hexane • Isobutyl Alcohol • JP-4 and JP-5 Fuels
Kerosene • Methylene Dichloride • Trichloroethylene • Turpentine • Water • MIL-F-25558A Fuel • MIL-L-7808 Lubricants
MIL-O-5606 Hyd. Fluid • MLO-8200 Hyd. Fluid • MLO-8515
Hyd. Fluid • Naphtha • Nitrogen • OS 45-1 Hyd. Fluid • Petroleum Base Oils • Silicone Fluids • Steam • Wet Chlorine Gas
For complete technical data—including list of incompatible fluids, request Bulletin 56700-1. Linear Inc., State Road and Levick St., Philadelphia 35, Pa.
PERFECTION IN RUBBER
LINEAR
Circle **76** on Time-Saver Card

BRIEFS

manager, engineering liaison, Pall Corp., Glen Cove, N.Y.

The conference will be in the New York Coliseum, May 23-26. Sponsor is ASME's machine design division. The Design Engineering Show will be there at the same time. ▼▼▼



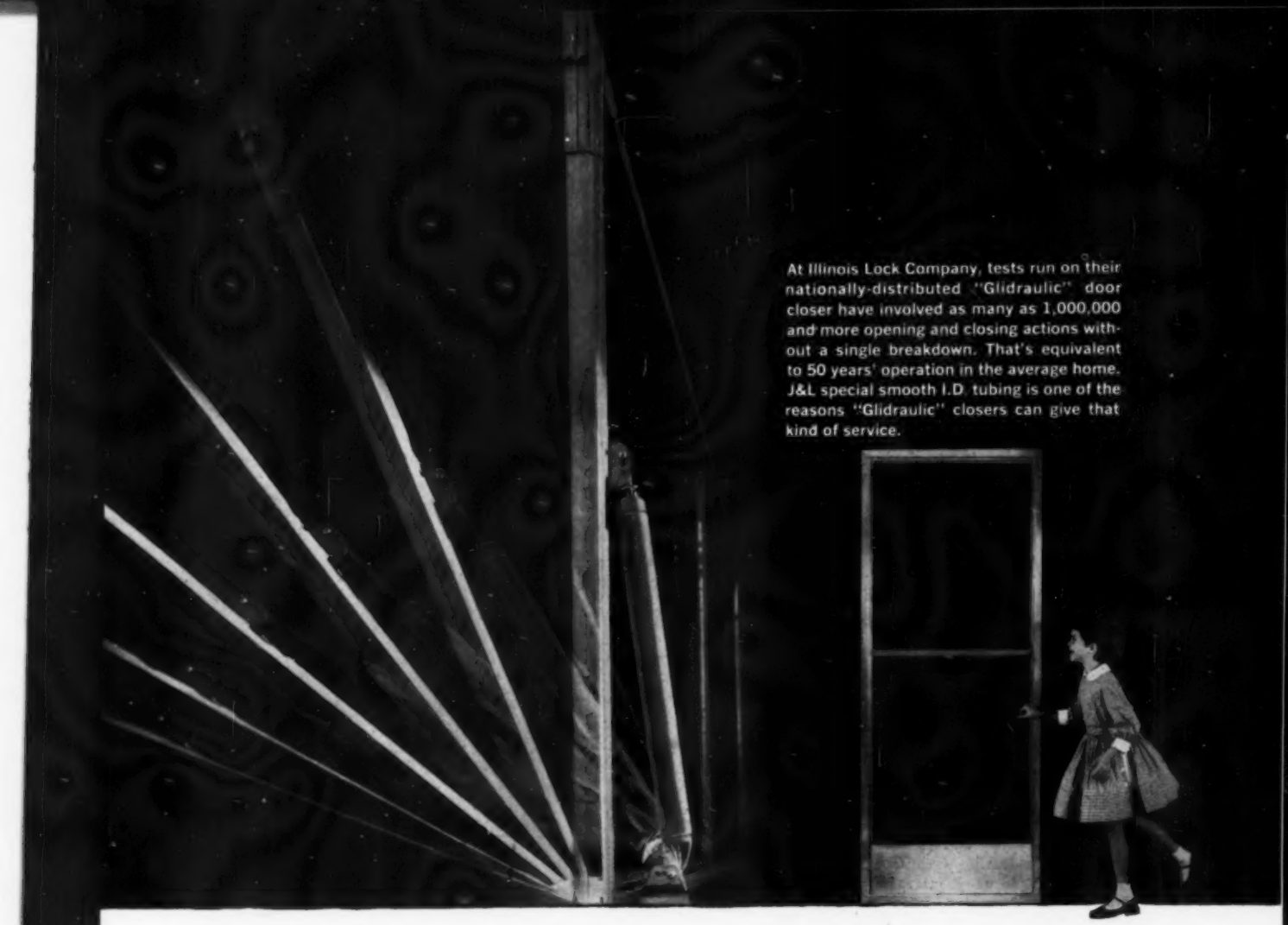
THIS NARROW-AISLE, ELECTRIC TRUCK has a single drive wheel and offset caster. A separate motor furnishes power for the hydraulic circuit which controls the fork mechanism, clamps, tilting forks, die-handling devices, and other special attachments. Made by the Raymond Corp., Greene, N. Y., the unit continuously raises 4000-lb. loads as high as 20 feet, without overheating.

Numerical Tape Automates Bender

Programmed, paper tape directs the automatic operation of a machine designed for tailpipe bending. Bending is powered by a rotary actuator. Bend angles can be programmed to minimum of 0.36 deg. Three primary motions —bending, flattening, and cutting off—and thirteen auxiliary functions can be programmed. It makes six bends per minute. The machine can produce 60,000 tailpipes per year. One unskilled laborer can operate it.

Baldwin-Lima-Hamilton developed the machine. General Electric designed the control system. ▼▼▼

More Briefs on page 32



At Illinois Lock Company, tests run on their nationally-distributed "Glidraulic" door closer have involved as many as 1,000,000 and more opening and closing actions without a single breakdown. That's equivalent to 50 years' operation in the average home. J&L special smooth I.D. tubing is one of the reasons "Glidraulic" closers can give that kind of service.

OVER 1,000,000 OPENING-CLOSING ACTIONS

of "Glidraulic" door closer prove quality of J&L Electricweld cylinder tubing

"The consistently high quality of J&L special smooth I.D. tubing is a must for us because we guarantee our sealed hydraulic door closers for 15 years," says Stanley Wolniak, product engineer of the Illinois Lock Company, Chicago, Ill. J&L tubing has to be rugged to take continuous operation like this *without failure of any kind.*

"The excellent inside finish of J&L Electricweld cylinder tubing requires no machining and prevents wear due to piston travel," Mr. Wolniak adds. "Its great wall strength resists bending under heavy pressure. And because of the uniform true diameter of J&L special smooth I.D. tubing, we don't have to pay the added cost for restricted tolerance tubing.

"As our door closers use hydraulic action, the cylinder tubing must meet critical requirements. For our purposes, J&L electric-resistance-welded tubing is the finest available."

Illinois Lock Company purchases J&L Electricweld tubing in ready-to-use 12" lengths, deburred at the mill. No inside honing or other cylinder machining operations are necessary.

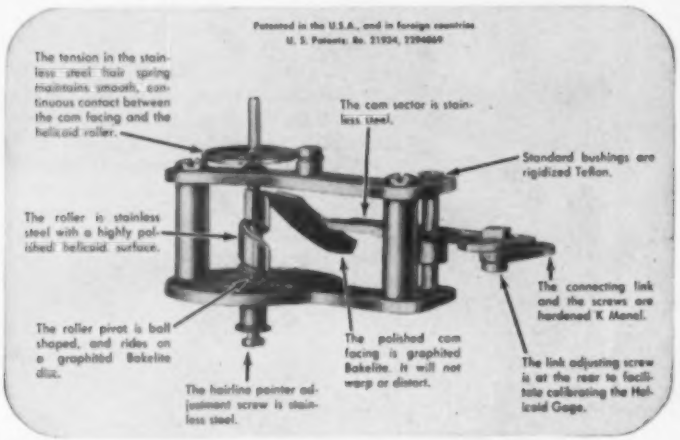
J&L STEEL

Jones & Laughlin Steel Corporation

ELECTRICWELD TUBE DIVISION
PITTSBURGH, PA.

Circle **67** on Time-Saver Card

ACCO Helicoid Gage U.S.A.


Patented in the U.S.A., and in foreign countries
U. S. Patents: Re. 21934, 2294869
The tension in the stainless steel hair spring maintains smooth, continuous contact between the cam facing and the helicoid roller.
The cam sector is stainless steel.
Standard bushings are rigidized Teflon.
The roller is stainless steel with a highly polished helicoid surface.
The connecting link and the screws are hardened K Monel.
The roller pivot is ball shaped, and rides on a graphitized Bakelite disc.
The polished cam facing is graphited Bakelite. It will not warp or distort.
The link adjusting screw is at the rear to facilitate calibrating the Helicoid Gage.
The hairline pointer adjustment screw is stainless steel.

Exclusive Helicoid movement provides... *Sustained Accuracy... on the toughest jobs*

• Helicoid Gages have no gears, no teeth, reducing wear to an absolute minimum. No danger of fouling, either—rolling action of cam facing keeps contact surface clean. Helicoid Gages have been tested through 75,000,000 cycles, with virtually no wear or loss of accuracy, while conventional geared gages became useless after 500,000 cycles.

Helicoid Gages give *sustained* accuracy even when subjected to violent pressure pulsations or mechanical vibrations. Pointer can be set externally, without removing glass, and cannot be jarred out of position. Dial faces are easy to read, won't corrode or chip. A full range of Helicoid Gages is available for any application. Next time, specify Helicoid—the gage that *stays* accurate.

Bourdon Tubes won't Stretch, Leak, or Crack

Helicoid Bourdon tubes are made from seamless tubing, and are designed for maximum torque and minimum stress. At the factory, each tube is individually tested, overpressured, and stress relieved. Four materials—alloy steel, K Monel, stainless steel, and phosphor bronze—are available to meet applications ranging from tap water to almost any acid.

NEW! Solid-Front Safety Case Gives Added Protection

The new Helicoid solid-front case diverts the force of a burst in a backward direction, away from the operator. The force escapes by deforming, though not detaching, the back cover plate. Helicoid Gages are also available in phenol, acaloy flanged, acaloy flangeless, polished flangeless, round flush, polished flush ring, and square flush cases.

WRITE for details

Ask for Catalog DH-65

Distributed in Canada by
Upton, Bradeen & James, Ltd.
Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Edmonton, Vancouver

HELICOID GAGES

Helicoid Gage Division • American Chain & Cable Company, Inc.
929-H Connecticut Ave., Bridgeport 2, Conn.

ACCO

Circle **56** on Time-Saver Card

BRIEFS

Hydraulics Speeds Food Handling on Jets

Getting hot food aboard luxury, jet airliners during the brief periods these giants are on the ground has brought about some unusual developments in truck-containers. Galley doors on the

new planes are so high that standard delivery trucks cannot load directly. One airline food servicing firm uses a scissors-type, vertical lift, truck hoist, carrying a cargo van with special doors.

Twin telescopic cylinders raise the van 13.6 feet. The van mounts on a main lift frame with I-beam side rails and four cross members to eliminate side sway. The van is built by General Body Co., Chicago, on a chassis made by Clark Equipment Co. ▼▼▼

Cylinder Powers Slide Table

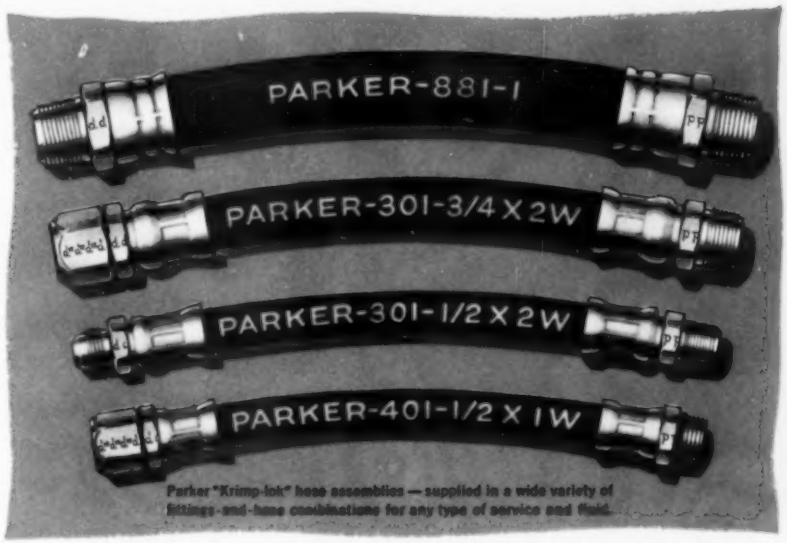
On an indexing slide table, a 3″-bore air cylinder or a 2″-bore oil cylinder provides two positions for metalworking. Two stop rods on the ends of the lower slide member vary stroke length infinitely from 1″ to 15″. The cushions take effect a half-inch from contact at either end. A needle valve controls cushion speed. Optional valve and electrical combinations provide almost any type of slide control. A 4-way valve and speed control valves control slide direction. An electrical kit

Continued on page 36

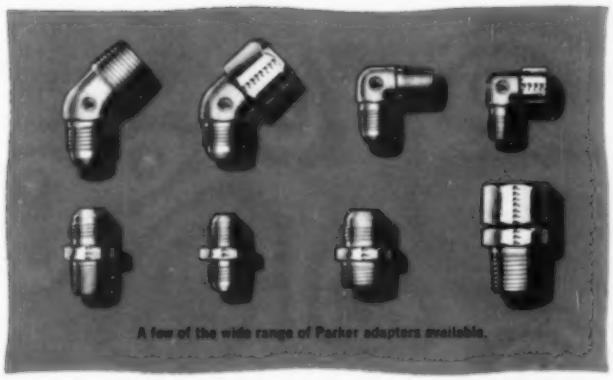
PARKER-HANNIFIN FLUID-SYSTEM COMPONENTS

Now from Parker

BOTH permanent-end and re-usable hose assemblies



Parker "Krimp-lok" hose assemblies — supplied in a wide variety of fittings-and-hose combinations for any type of service and fluid.


A few of the wide range of Parker adapters available.

You may require permanent-end hose assemblies for your production AND re-usable fittings with coils of hose for quick, trouble-proof replacements in the field. With the addition of Parker's new "Krimp-lok" fittings, permanent-end assemblies are now available from Parker. They use the same Parker hoses that enjoy a wide acceptance when used with Parker *no-skive* "Hoze-lok" fittings in the replacement field.

A full range of Parker adapters is also available.

Ask your Parker Hose Distributor, listed in the Yellow Pages, for engineering advice and literature on "Hoze-lok" re-usable fittings, also Parker hose and adapters. Write us in Cleveland regarding your requirements for Parker "Krimp-lok" Hose Assemblies.

Parker

FITTINGS AND HOSE DIVISION

17325 Euclid Avenue

Cleveland 12, Ohio

Parker "Hoze-lok" no-skive hose fittings and Parker hose, the ideal combination for mass-production and quick, reliable field replacement.

A DIVISION OF PARKER-HANNIFIN CORPORATION

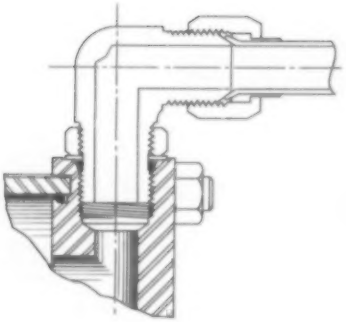
Bronze cartridge gland with "LIPSEAL"® and "WIPERSEAL" can be easily replaced without dismantling cylinder.

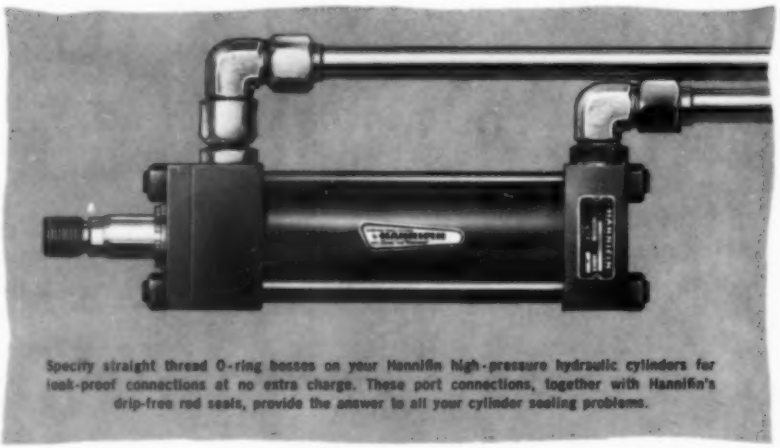
Drip-free rods, leak-proof ports...

get both with

HANNIFIN

hydraulic cylinders





Specify straight thread O-ring bosses on your Hannifin high-pressure hydraulic cylinders for leak-proof connections at no extra charge. These port connections, together with Hannifin's drip-free rod seals, provide the answer to all your cylinder sealing problems.

For absolutely leak-proof connections under all operating and installation conditions, get Hannifin hydraulic cylinders with S.A.E. straight-thread ports. There's no extra cost. And because a straight-thread fitting is tightened *after* alignment, not aligned by "backing off," sealing is positive even when the cylinder must be mounted in tight quarters.

Straight-thread ports, plus the removable-replaceable cartridge gland that seals Hannifin cylinder rods drip-free, keep machines, floor and product free of hydraulic oil.

Other Hannifin cylinder features include ground and polished rods induction-hardened to an extra-deep case, then hard-chrome plated and polished again; cylinder walls that are "Tru-Bored" straight and perfectly round *before* being honed . . . PLUS 48-hour shipment in emergencies on standard Hannifin cylinders.

Your nearest Hannifin sales office or representative is listed in the A-Z volume of Thomas' Register. Call us in when cylinders figure in your designs. Or, for cylinder literature, write:

HANNIFIN COMPANY

515 South Wolf Road • Des Plaines, Illinois

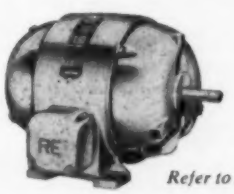
"Molded Horsepower" to fit your equipment

...no longer must you "make something do!"

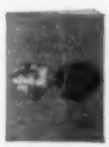
Just as a famous artist molds each illustration to his need... so, too, can you now have an electric motor exactly tailored to the needs of your equipment. Not just another motor that can be "made to fit" but a complete power package with all desired electrical and mechanical characteristics built right in.

Reuland "Molded Horsepower" is a natural outgrowth of the famous "Xpandable" design idea originated by Reuland many years ago. Through this technique, motors, brakes, fluid couplings, gear reducers and similar devices are available in an almost unlimited number of combinations... all standard units assembled within a single frame and tailored to your specific application.

Only Reuland offers such a wide background of experience in tailored power packages. No wonder Reuland is also the "number one" supplier to many of the top original equipment manufacturers in America!



Our new 8-page catalog, No. GS8-30-0, will come in handy. Sent complete with prices and engineering drawings on request.



Refer to Sweet's Product Design, Section 5-a

MODERN POWER FOR MODERN-DAY PRODUCTS

... all in lightweight, cool-running aluminum frames!

REULAND MOTORS

REULAND ELECTRIC COMPANY
WESTERN DIVISION: *Alhambra, Calif.*
EASTERN DIVISION: *Howell, Mich.*
Distributors in all principal cities

For Cylinders, Circle **54**
For Fittings & Hose, Circle **95**

Circle **107** on Time-Saver Card

BRIEFS

operates the slide manually or automatically. Adjustable cam bars on the front cover plate actu-

ate right and left limit switches. The working surface of the slide member is 30″ x 12″. Manufacturer is Russell T. Gilman, Inc., Milwaukee. ▼▼▼

Central Hydraulic System For Cars

The Electric Autolite Co., Toledo, Ohio has developed a miniaturized, experimental, central hydraulic system for automobiles. The hydraulic pump which powers the system is finger-tip size and develops ⅛ hp. At present the French Citroen is the only car in production which has a central system. American cars have separate systems for power brakes and power steering. Engineers of the "Big Three" are attempting to standardize on a hydraulic fluid for all cars. This would

Continued on page 38

BRIEF NOTES

POLYPROPYLENE BLOCKS FOR VALVE PROTOTYPES . . . are offered by American Agile Corp., Maple Heights (Cleveland), Ohio. The material is easily machined, ground, drilled, threaded, and welded with standard woodworking or machine tools. It has excellent impact resistance. It withstands 240 F under average service load conditions.

13,500 FIRMS WILL EXHIBIT . . . at the 38th annual Milan Trade Fair, Milan, Italy, April 12-27. More than 3200 of the exhibitors will be from the United States, South America, Asia, Africa, the Middle East, Russia, and European countries other than Italy. Buyers and technicians from 112 countries and territories will attend. Manufacturing machinery, and aircraft, marine, and automotive products will be displayed.

FLUOROCARBON DIVISION FORMED . . . by Plastic & Rubber Products Co., Los Angeles. The division will fabricate O-rings, V-ring packings, Teflon scraper rings, grommets, static face seals, and back-up and spiral back-up rings. Materials to be processed include Teflon, Kel-F, nylon, and polyethylene. Constant temperature in the Gardena, Calif., plant will be 72 F, with a 50% humidity factor. Pressurization will control dust in the processing and molding areas. The cooler, pump, thermostat, and filtering system will remove particles above 2 microns.

CUNNINGHAM GETS SAE AWARD . . . E. N. Cunningham, sales manager of Precision Rubber Products Corp., Dayton, has received a certificate of appreciation from SAE. He was cited for his work as chairman of subcommittee AE-3A, elastic seals. He directed preparation of Aeronautical Recommended Practice 568, "Uniform Dash Numbering System for O-rings."

ROYLYN, INC. OPENS PRECISION DRILLING DEPT. . . . The Glendale, Calif. facility will be used on Roylyn products. Its services are available to those who want them. The drills make holes from .002″ to .125″ in diameter, graduated in .0001″ tolerances. They can go eight times deeper than their diameters, into metals to 35 Rockwell C. in hardness.

FILING REFERENCES . . . for engineers who want to organize their material are available from the Engineering Societies Library, New York. The references are to books and articles on filing, classification, and indexing; lists of subject headings; and card systems. A subject index and a discussion of systems are furnished.

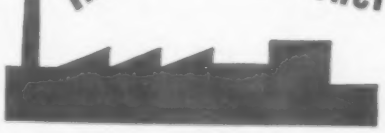
How to select COMPATIBLE Packings for fire-resistant hydraulic fluids!

HOUGHTON
THE ONLY COMPLETE LINE OF
PACKINGS & FLUIDS
FOR ANY INDUSTRIAL HYDRAULIC SYSTEM

Use this handy guide for your protection in selecting packings for fire-resistant hydraulic fluids. It's your guarantee of a completely unbiased recommendation . . . for it comes to you from the only manufacturer who makes both packings and fluids for any industrial hydraulic system. For details or help on any hydraulic packing problem, call your Houghton Man, or write: E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

TYPE OF FIRE-RESISTANT HYDRAULIC FLUID	COMPATIBLE PACKING COMPOUNDS*	HOUGHTON PACKING BRANDS
Water-Glycol	Homogeneous Buna N	Vix-Syn 10V70—O-Rings and U-Cups; Vix-Syn 10V90 "V's"
HOUGHTO-SAFE 600 Series	Fabricated Neoprene	Vix-Syn 3081 Cups and 1081 "V's"
Phosphate-Ester	Homogeneous Butyl	Vix-Syn 10V70-132 O-Rings and U-Cups; 10V85-94 "V's"
	Fabricated Butyl	Vix-Syn 3067 Cups and 1067 "V's"
HOUGHTO-SAFE 1000 Series	Leather-Impregnated with Polysulfide	Vim Leather No. 1243 Cups, "U's", "V's" and Flanges
	Leather-Impregnated with Wax	Vim Leather No. 1231 Cups, "U's", "V's" and Flanges
Water-Oil Emulsion	Homogeneous Buna N	Vix-Syn 10V70 O-Rings and U-Cups; 10V90 "U's"
	Fabricated Neoprene	Vix-Syn 3081 Cups and 1081 "V's"
HOUGHTO-SAFE 5040 Series	Leather-Impregnated with Polysulfide	Vim Leather No. 1243 Cups, "U's", "V's" and Flanges
	Leather-Impregnated with Wax	Vim Leather No. 1231 Cups, "U's", "V's" and Flanges

*Under certain conditions of temperature, pressure or chemical composition, special packing materials may be necessary. When in doubt, consult your Houghton Man first.



Industry's Partner in Production

E. F. HOUGHTON & CO.

Philadelphia, Pa. • Chicago, Ill. • Carrollton, Ga. Detroit, Mich. • San Francisco, Calif. • Toronto, Canada

QUALITY THAT PRODUCES TOP PERFORMANCE

FIXED BUNDLE

Yates-American

HEAT EXCHANGERS

- Flanged baffles . . . pioneered by YA eliminate vibration wear and provide maximum efficiency.
- Rolled tube joints . . . industry accepted standard of quality construction.
- Single and Multiple Pass Designs . . . available in 2" through 10" diameters.
- Now available from stock.
- Ask for Bulletin HT-1A.

ENGINE COOLING RADIATORS

Over 75 years of service to industry

HEAT TRANSFER DIVISION

Yates-American

MACHINE COMPANY

705 4th St. BELOIT, WISCONSIN

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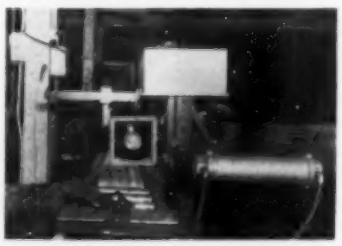
BRIEFS

speed introduction of central hydraulic systems. If standardized, miniaturized, hydraulic controls are widely available, other manufacturers may be encouraged to use them on their products. ▼▼▼

"Sir, Fenton Here Has Discovered A New Property In Our Hydraulic Fluid".

Pneumatics Speeds Packing

Air power closes wirebound boxes and pushes them onto a conveyor in a machine development of Stapling Machines Co., Rockway, N.J. The closing machine

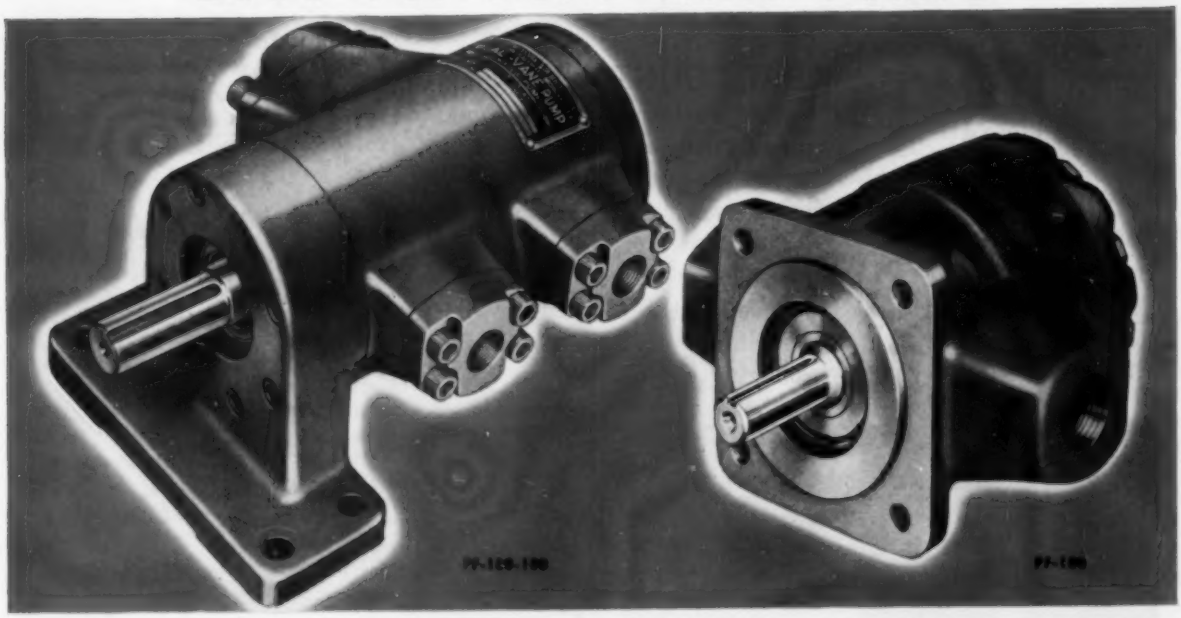


handles boxes at General Electric's Baltimore plant. It has saved 20% of their packing time. After packing four to eight high-voltage, suspension insulators, the operator folds the lid shut, threads the wire-loop fasteners, and pushes the box onto the closing machine conveyor. At the machine, a bar clamps the box against a frame, to square the

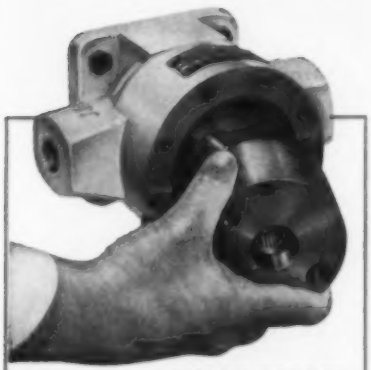
Continued on page 40

HYDRECO® PRESENTS—

THE *NEW* SERIES PF-100
2000 PSI DUAL-VANE PUMPS



NEW CAM DESIGN • *IMPROVED* CARTRIDGE DESIGN



DUAL-VANE CARTRIDGE CONSTRUCTION

A feature of Dual-Vane Pumps for many years . . .

HYDRECO Dual-Vane Pumps may be serviced in minutes because all pumping parts are contained in an easy-to-install cartridge. No special tools are required to replace a cartridge or change to one of a different capacity. Direction of Pump rotation is simply a matter of turning the cartridge end for end.

Significant superiority in *performance, service life* and *quiet operation* are the advantages now available to YOU in these advance design Dual-Vane Pumps. For builders of Machine Tools, Presses, Injection Molding Machines, etc. Series PF-100 Hydraulic Pumps answer your needs for continuous or intermittent Fluid Power applications at low initial cost. Single Pumps deliver 3 to 11 gpm at 1200 rpm, 2000 psi . . . Double Pumps to 22 gpm . . . foot and flange mounted models.

These new design advantages are also available in Dual-Vane Pumps of larger capacity – up to 140 gpm at 2000 psi.

WRITE FOR ALL THE FACTS ON THE NEW PF-100 DUAL-VANE PUMPS

HYDRECO DIVISION
THE NEW YORK AIR BRAKE COMPANY
9004-6 EAST MICHIGAN • KALAMAZOO • MICH.

Please send me full information on your NEW Series PF-100 Dual-Vane Pumps.

Name_____

Company_____

Address_____

City_____ Zone____ State_____

IT'S WHAT HAPPENS ON

your job

THAT COUNTS! BHEW 'on-the-job' performance saves you money! Costly breakdowns and expensive maintenance do not make for efficiency. With BHEW products you are assured of dependable performance, long life and easy maintenance. These are the custom features that characterize all BHEW products.

BHEW's Hollow Rod Cylinders are two-piece tubular rods that allow oil to flow through the rod in two separate channels to operate double-acting cylinders. You benefit from this application because the cylinder barrel is plain without port connections and the rod is anchored in a stationary position. The barrel is the reciprocating member.

DISCUSS YOUR DESIGN AND APPLICATION PROBLEMS WITH US!

WRITE TODAY for free Hydraulic Cylinder Engineering Reference data. 78 dimensional basic designs for general purpose and special double- and single-acting cylinders. SAVE TIME!

BH EW

INTEGRITY • CHARACTER • QUALITY

BENTON HARBOR ENGINEERING WORKS, INC.

622 Langley Avenue • St. Joseph, Michigan

Circle **24** on Time-Saver Card

BRIEFS

box. Another bar presses the fasteners against the side of the box, and activates the conveyor. At the end of the conveyor, the box activates a cylinder fitted with a bellows and a metal plate. The plate pushes the box onto another conveyor which goes to the floor. ▼▼▼

Filter Elements are Cleaned in "Clean Room"

To further quality control of aircraft and missile filters, Purolator Products, Inc., has designed and built a "clean room". There, elements are cleaned by ultrasonics, and by boiling in detergents and chemical degreasing agents.

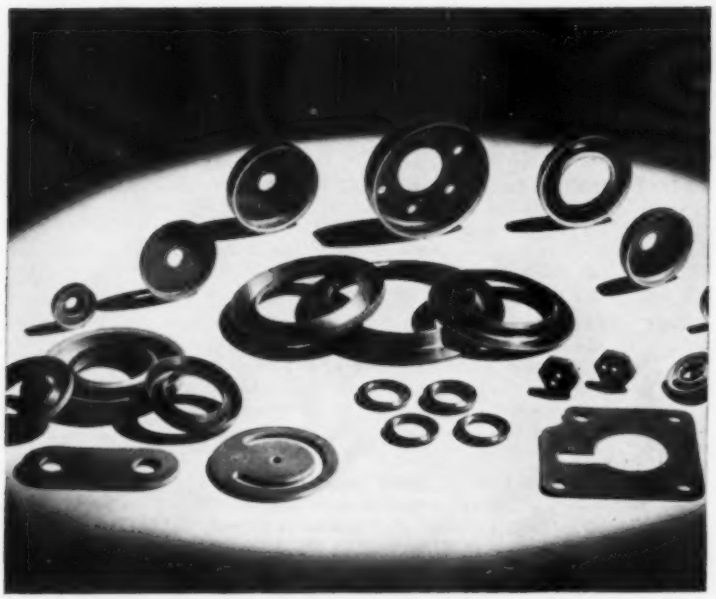
The room is under 24-hour pressurization. It can be entered

WIRE-MESH FILTER ELEMENTS are immersed in the ultrasonic chamber, where they are cleaned with chemical solutions. After washing, 40,000-cps electric waves are shot through the tank.

only through an air-locked chamber where personnel don lint-free clothing. Air is filtered before entering the room. To minimize costs, a roof-mounted blower pulls air out of the adjacent office's air-conditioning system. Air is exhausted through a roof stack which is equipped with an auxil-

Continued on page 42

MECHANICAL LEATHERS
in Design Engineering



NATURALLY TOUGHER THAN OTHER MATERIALS

Garlock Mechanical Leathers—being of steerhide—have an unmatched tensile strength and toughness. Also, leather packings have a low coefficient of friction, minimum cold flow. They provide extremely good resistance to abrasion and wear . . . actually tend to polish metal surfaces which they contact!

Garlock leather packings can be impregnated for a variety of hydraulic applications. For example, they can be made soft and flexible for low pressures; semi-rigid for intermediate pressures; firm for high pressures.

Cold and hot water, oils, air, gas, oxygen, alcohol, glycerine, gasoline, kerosene, and other non-caustic fluids will not harm leather packings. They can be used in temperatures from subzero to +200° F. Garlock leather packings are suitable for pressures from a few ounces to many thousands of pounds per square inch.

In any of three leathers—BITAN*, Chrome, or Oak—Garlock can furnish all shapes, sizes, materials and designs of leather packings for hydraulic use. They're made in a modern packing plant which maintains highest standards of quality. Molded Cups, "U" Packings, "V" Packings, Washers, Gaskets, Discs, Flange or Hat Packings are some of the more commonly specified types. Sizes range from ⅛" O.D. leather washers for needle valves to 99" O.D. "U" Packings for heavy duty hydraulic service.

Contact your Garlock representative at the nearest of our 26 sales offices and warehouses throughout the U. S. and Canada. Or, write for Catalog AD-121,

GARLOCK

The Garlock Packing Company, Palmyra, New York.

Canadian Division: The Garlock Packing Company of Canada, Ltd.

Plastics Division: United States Gasket Company.

Order from the Garlock 2,000 . . . two thousand different types of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products

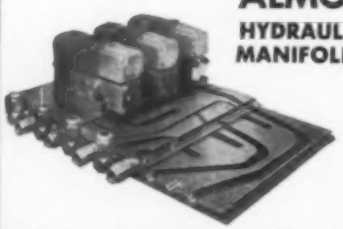
*Registered Trademark

Circle **46** on Time-Saver Card

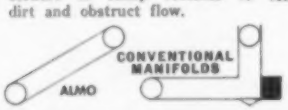
LET'S TALK MANIFOLD FACTS!

The advantages of (Almo) manifolds as opposed to other manifolds are many. Their unique design offers complete flexibility in the mounting of take-offs and valves. Thus an Almo manifold is more adaptable to your requirements. Here are 3 features that definitely effect performance, weight and size.

ALMO*
HYDRAULIC MANIFOLDS



1. Flow lines are short as possible with no corners or sharp recesses to collect dirt and obstruct flow.



2. Method of construction permits better utilization of area, smaller overall dimensions and fewer complications while maintaining correct channel dimensions and constant operating pressures. PSI capacity is a built-in quality.

3. Rectangular cross section of flow lines makes possible thinner overall construction and less weight than in comparable manifolds.

WEIGH THESE FACTS!

Let us work with you in improving your product. Write for brochure.

ENGINEERING RECOMMENDATIONS

"THE UNIQUE FLUID CIRCUIT"

ALMO
MANIFOLD & TOOL CO.
11472 KALTZ / CENTERLINE, MICH.

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BRIEFS

ary exhaust blower. It can be turned on if pressurization fails.

Air samples are taken every two hours. Millipore samplers, placed on the laboratory counters, are one of the means used to check particle settling rate. There has been no trace of particles over 50 microns. The maximum rate had been nine particles of 7 to 25 microns and five particles of 25-50 microns, in a two-hour period. Walls and ceiling are covered with a polished vinyl fabric. A sealer coats the vinyl floor to keep cement dust from seeping through the tiles. ▼▼▼

BUSINESS BRIEFS

GARLOCK PACKING TO CHANGE NAME . . . On April 16 at the annual meeting stockholders of Garlock Packing Co. will vote on a proposal to change the company's name to Garlock, Inc. A. J. McMullen, president, said the new name will end confusion which associates the company with the canning industry. Garlock produces industrial packing and sealing material.

PARKER-HANNIFIN EARNINGS HIGHEST EVER . . . An unaudited report to shareholders showed for the last six months of 1959 net sales of $25,717,734, and earnings of $1,503,279, or $1.15 per share. This is up 30% from the 1958 period, when net sales were $19,695,962, and earnings, $1,139,059, or 88c per share.

LARGE EXPANSION PLANNED . . . by Marsh Instrument Co., Div., Colorado Oil & Gas Corp. By late 1960, production capacity of the Skokie, Ill., plant will be increased by 40%. This is the third major enlargement of the plant in ten years. An increase of more than 25% in gross sales and a backlog of 75% above a year ago necessitated this expansion.

WABCO EARNINGS RISE . . . 1959 consolidated sales of Westinghouse Air Brake Co. and its subsidiaries were $209,448,298, up from $206,263,108 in 1958. Earnings after income taxes were $11,393,756, or $2.71 per share, up 29% from 1958's $8,798,313, or $2.10 per share.

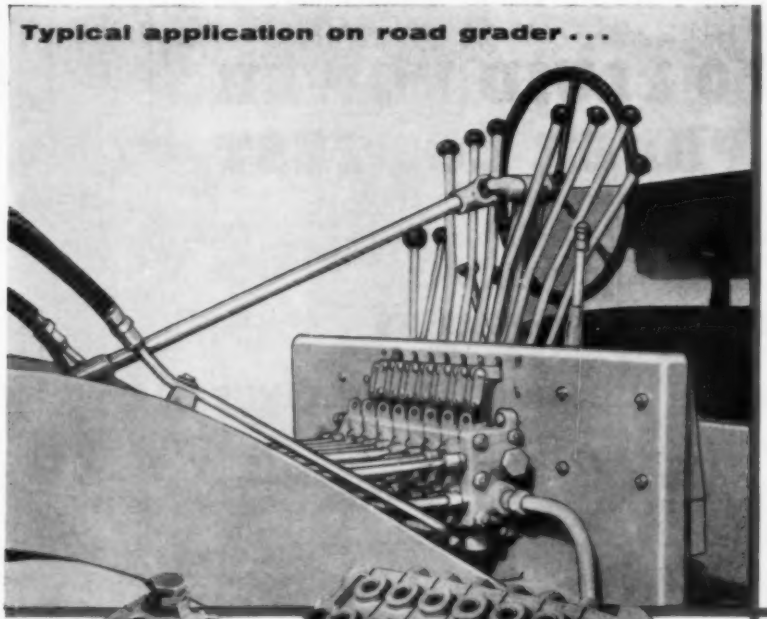
NEW FIELD GROUP TO SELL HYDRAULIC POWER PACKAGES . . . for General Electric's Aircraft Accessory Turbine Department. Headquarters will be in Lynn, Mass. Specialists in nine district offices will market accessory power equipment for aircraft, missile, space vehicle, marine, and ground applications.

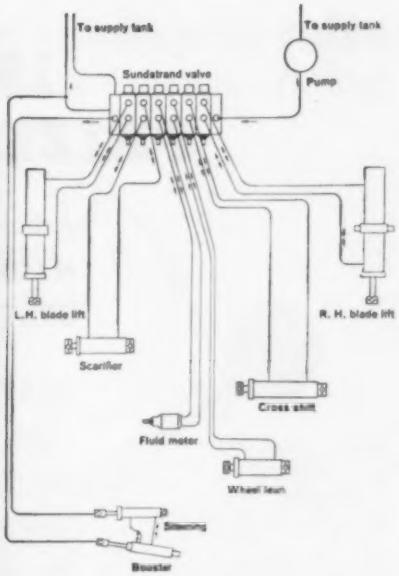
B&W NET INCOME UP 22% . . . The Babcock & Wilcox Co. announced that 1959 shipments of $332,071,000 generated a net income of $15,938,000, or $2.58 per share. Net income was the second highest in the firm's history. For 1958, shipments were $365,941,000, and net income was $13,035,000 of $2.11 per share. The 1959 backlog was $300,948,000; the 1958 backlog, $237,479,000.

DAYTON RUBBER BUYS METAL HOSE AND TUBING . . . Dayton Rubber Co. has agreed to acquire the assets of Metal Hose and Tubing Co., Dover, N. J., C. M. Christie, president of Dayton Rubber announced. The transaction is subject to completion of investigation now in progress. William D. Magagnos is president of Metal Hose and Tubing Co., which has been in operation since 1912 and employs about 250 people. Metal Hose manufactures steel and fiber reinforced rubber hose, sold under the "National" trademark. There will be no change in management or present distribution policies of Metal Hose, which will be operated as an autonomous subsidiary.

FLUID CONTROLS, INC. EARNS 64% MORE . . . The Mentor, Ohio firm's profits rose from $32,514 (81c per share) in 1958 to $53,217 ($1.33 per share) in 1959. Sales were up 37%, from $513,927 to $703,997.

How Sundstrand Series-Type Valves Help You Solve Multiple Control Problems on Heavy Machinery





"Building-block" design simplifies assembly and service

With Sundstrand multiple-section series-type valves, you can control any number of cylinders or fluid motors one at a time, or two or more simultaneously, regardless of system load. "Building-block" design permits combinations of up to 10 operating sections in a single compact assembly. Fast take-down and reassembly speed service, simplify maintenance.

Exclusive design features include specially grooved lands to eliminate imbalance of hydraulic forces within the valve . . . prevent spool binding . . . assure positive action at all times. Large flow passages reduce pressure drop . . . provide 80% more usable pressure. Long seal path eliminates internal leakage . . . lathe cut neoprene ring and wiper seals prevent external leakage. Integral relief valve is adjustable from 500 to 2000 psi. Series-type valves are available in ½" (25 gpm) and ¾" (35 gpm) sizes.

Write for details.

Put these advantages to work in your hydraulic control circuits

- Building-block design
- Compact, all-in-one construction
- Large flow passages
- Fully machined, precision-fit components
- Spring-centered or detent valve positioning
- Integral adjustable pressure relief valve
- Two sizes available: ½" (25 gpm), ¾" (35 gpm)

SUNDSTRAND

SUNDSTRAND HYDRAULICS

DIVISION OF SUNDSTRAND CORPORATION

2210 Harrison Ave., Rockford, Ill.—Eastern Sales Office: 89 Summit Ave., Summit, N. J.

AIRCRAFT AND INDUSTRIAL HYDRAULIC TRANSMISSIONS, PUMPS, MOTORS AND VALVES • OIL BURNER PUMPS • AIR SANDERS • LATHES, MILLING, BROACHING AND SPECIAL MACHINES BROACHING TOOLS • MAGNETIC CHUCKS • PACKAGING MACHINERY

8th Annual Competition

1960 FLUID POWER PRIZE PAPER CONTEST

Articles about:

HYDRAULIC AND PNEUMATIC SYSTEMS AND COMPONENTS

DESIGN • APPLICATION • MAINTENANCE

FIRST PRIZE	$500
SECOND PRIZE	$300
THIRD PRIZE	$200
4th to 7th PRIZES, EACH	$100

All prize papers will be published in APPLIED HYDRAULICS & PNEUMATICS Magazine. Papers receiving honorable mention awards will also be published and paid for at regular rates.

CONTEST CLOSES JULY 1, 1960

Committee of Judges:

J. A. Draxler, Chief Engineer, Elwell-Parker Electric Co.

R. K. Sedgwick, Assistant Chief Engineer, Servo Machine Tool Div., Kearney & Trecker Corp.

W. E. Mayhew, Staff Engineer, Advanced Fluid Systems Research & Development, Republic Aviation Corp.

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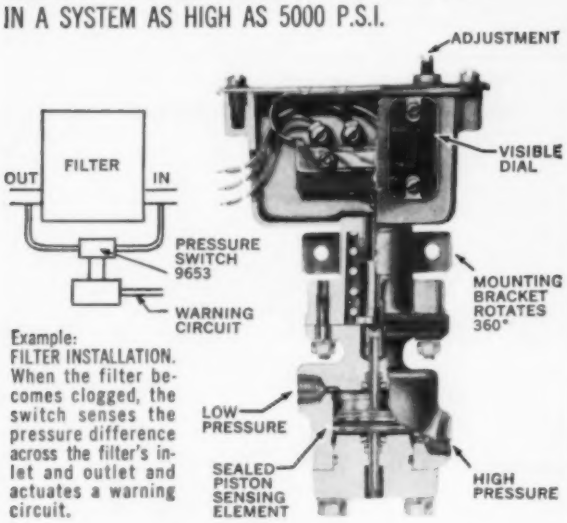
812 HURON ROAD, CLEVELAND 15, OHIO

Circle **240** on Time-Saver Card for 1960 Prize Paper Booklet

NEW PRESSURE DIFFERENCE SWITCH

SENSES A LOW DIFFERENCE OF 10 P.S.I. EVEN IN A SYSTEM AS HIGH AS 5000 P.S.I.



Example: FILTER INSTALLATION. When the filter becomes clogged, the switch senses the pressure difference across the filter's inlet and outlet and actuates a warning circuit.

The new Model 9653 is constructed to sense a difference from 5 P.S.I. to 140 P.S.I. between two pressures. A sealed piston sensing element actuates an electric circuit on increasing or decreasing of a predetermined pressure difference. It is applicable to oil systems ranging from 50 P.S.I. to 6000 P.S.I. working pressure. A high proof pressure rating of 9000 P.S.I. is your protection against damage from surges and shock loads. Field setting is simplified by means of an external adjustment screw and visible dial.

WE BUILD IN	WE DON'T USE
RUGGEDNESS Can take surges— (High proof pressures) Continuous operation— (Millions of cycles) No sticking— (in dirty fluid)	**LINKAGES & BEARINGS** Which wear quickly—(cause settings to drift and switch to fail).
LABOR & MATERIAL SAVINGS No return drain piping— (Sealed piston) Mounts where convenient (Operates in any position, Not sensitive to vibration)	**UNSEALED PISTONS** Which add to your installation cost (return piping). Are critical to dirt— (pistons get stuck).

Ask for new pressure switch handbook and catalog '59-'60

PRESSURE SWITCH DIVISION

Barksdale valves

5125 ALCOA AVENUE, LOS ANGELES 58, CALIFORNIA

Circle **19** on Time-Saver Card

NEW!

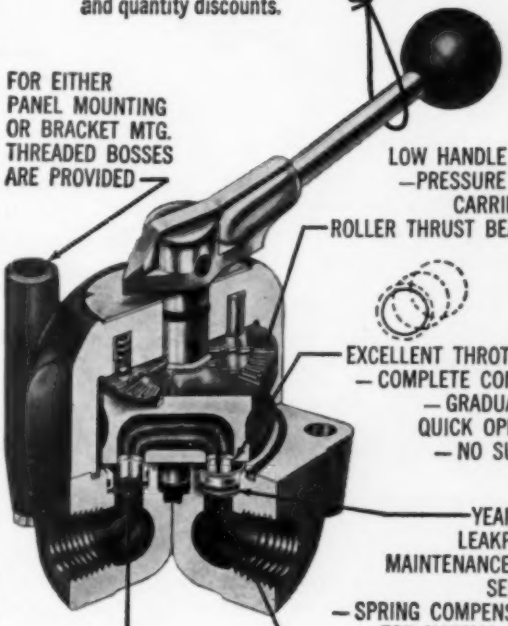
A "SHEAR-SEAL" VALVE

for LESS than a spool valve

RATED FOR 3000 P.S.I. OIL SYSTEMS

$65.00
List Price*
for a ¾" valve

*Less the usual O.E.M. and quantity discounts.


FOR EITHER PANEL MOUNTING OR BRACKET MTG. THREADED BOSSES ARE PROVIDED
LOW HANDLE LOAD —PRESSURE LOAD CARRIED BY ROLLER THRUST BEARING
EXCELLENT THROTTLING — COMPLETE CONTROL — GRADUAL OR QUICK OPENING — NO SURGES
YEARS OF LEAKPROOF MAINTENANCE-FREE SERVICE — SPRING COMPENSATES FOR NORMAL WEAR
MORE FLOW THRU UNOBSTRUCTED ROUND FLOW PASSAGES
NO EXTERNAL LEAKAGE — PRESSURE IS CONFINED TO FLOW PASSAGES

For complete data on this new valve and for information on all your valve requirements write for Catalog V-59-60

CONTROL VALVE DIVISION

Barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

Circle **20** on Time-Saver Card

NEW PRODUCTS

Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.

STAINLESS, AIR CYLINDERS . . . 1-1/16" bore

Features: Stainless bodies have high finish. Ground and polished

stainless rods. U-cup piston and piston rod seals. Rolled-in construction. Double acting, double rod end.

Specifications: 1 1/16" bore. Strokes to 18".

Bimba Mfg. Co.
Monee, Illinois

Circle **300** on Time-Saver Card

VARIABLE VOLUME VANE PUMP . . . is pressure compensated

Features: Pump delivery varies according to system needs, while maintaining preselected pressure. Maximum delivery can be limited by mechanical adjustment. Integral, pressure compensator can be set

from 200 to 500 psi. Delivers nearly full volume up to compensator setting even at low operating pressures because of sharp cut-off characteristics. Eliminates relief valve and connecting lines because of variable volume and pressure compensation features.

Specifications: For operation with 1800-rpm motor. 6-gpm delivery, up to 500-psi pressure. Available in flange, foot, or gasket mounting.

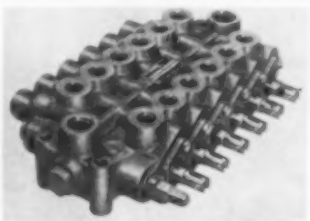
Vickers, Inc.
Detroit, Mich.

Circle **301** on Time-Saver Card

MULTIPLE SPOOL VALVE . . . can incorporate other controls

Designation: V-33.

Features: Has parallel, internal circuits designed for heavy duty, mobile equipment. May have built-in swing cushioning valves for



boom control, flow control and counterbalance valves. May also have pilot-operated overload relief valves on individual cylinder circuits.

Specifications: For 20 gpm at 2000 psi. Available in 2, 3, 4, and 6-plunger models.

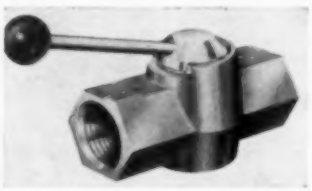
Hydreco Division
The New York Air Brake Co.
Kalamazoo, Mich.

Circle **302** on Time-Saver Card

PLUG VALVE . . . has cylindrical plug

Designation: 9200 Series

Features: For non-corrosive liquids and gases. Two O-rings in grooves near each end of plug provide seal when valve is open. O-ring is in lipped groove in face of plug, 90 deg. from plug flow passage. When valve is closed, this O-ring moves around inlet port. It is not damaged



when passing inlet port. Plug floats on O-rings, requires no critical adjustment. O-rings can be replaced quickly, without removing valve from line. Buna N or Neoprene O-rings. Standard valves are brass. Specials in aluminum or 303 stainless steel.

Circle Seal Products Co., Inc.
Pasadena, Calif.

Circle **303** on Time-Saver Card

TANK-SUMP DRAIN . . . cleans without air flow

Designation: 5100-4, 5101-8.

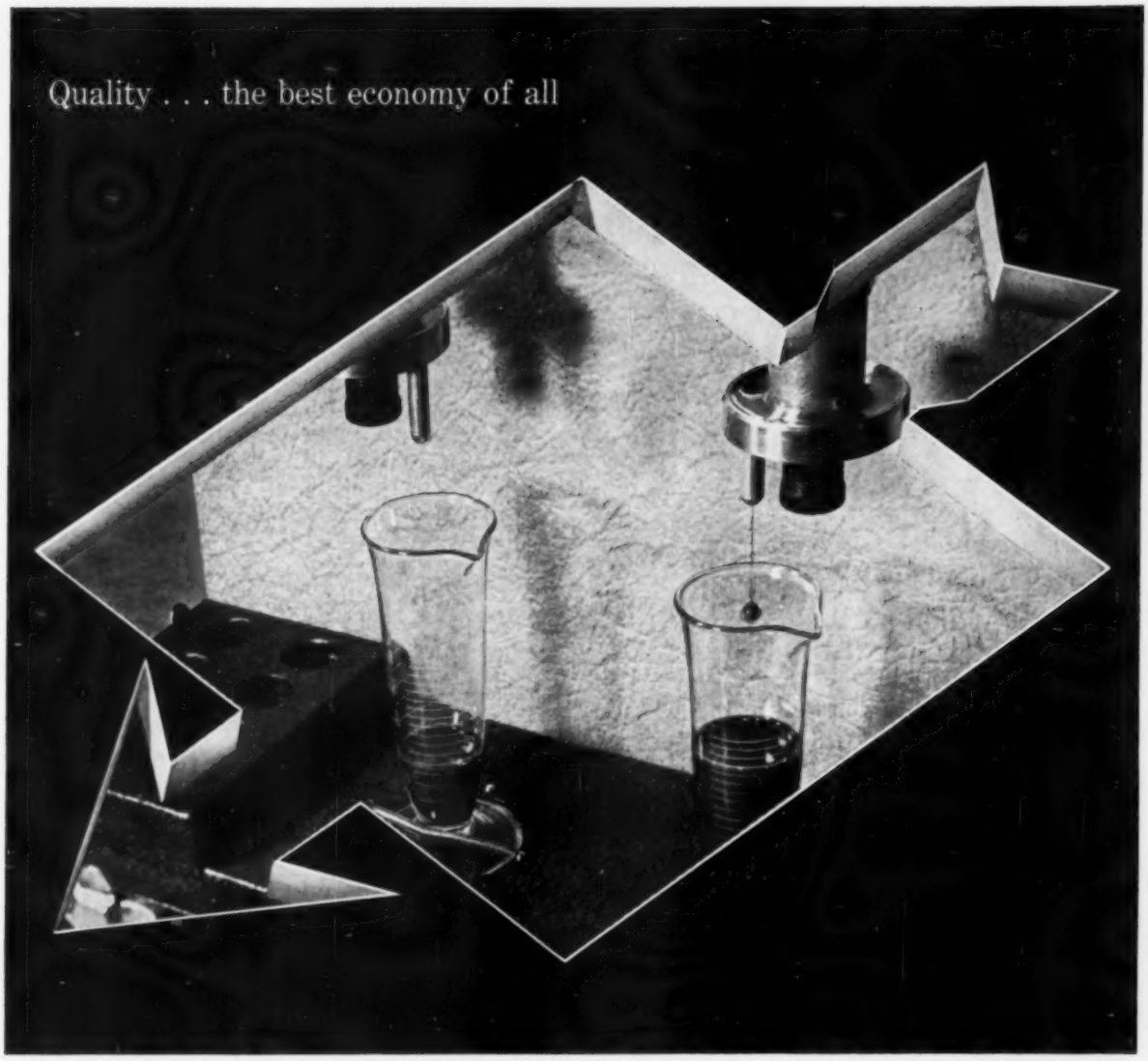
Features: Contamination removed as long as 10-psi air pressure remains in system. Moisture and sludge raise float which operates a pneumatic diaphragm opening drain valve. Unit also used for auxiliary storage tank, aftercooler, drop-leg, end-of-line installation. Converts manually drained filters to automatic operation.

Specifications: 5101-8 collects and discharges to 500 gph. Both available in ½" and 1" sizes, to 250-psi pressure.

Wilkerson Corp.
Englewood, Colorado

Circle **304** on Time-Saver Card

For more NEW PRODUCT reviews turn to page 130



Under 100-psi pressure in desk-top Suntac demonstration, a straight mineral oil leaks out four times faster than Suntac of the same viscosity.

You can cut oil leakage as much as 75% simply by switching to a Suntac oil

Don't cuss your "problem" leaker, don't look for a bigger drip pan—try a Suntac oil.

Suntac oils, besides their exceptional lubricating qualities, have the remarkable capacity to *stay put* instead of dripping out and making floors unsafe.

Match Suntac against the oil you're now using. Notice how its non-gummy antileak characteristic can reduce your oil losses as much as three-fourths. In fact, *many users report oil savings up to 90%!*

Have your Sun representative arrange for the five-minute demonstration shown above—right on your desk top. Or write for Suntac information to SUN OIL COMPANY, Phila. 3, Pa., Industrial Products Dept. AH-4. In Canada: Sun Oil Company Limited, Toronto & Montreal.

SUNOCO

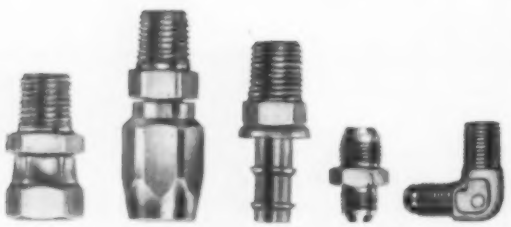
MAKERS OF FAMOUS CUSTOM-BLENDED BLUE SUNOCO GASOLINES

NOW FROM STEWART-WARNER...

New SURGEPRUF® couplings and hose

Now from one reliable source, you can obtain hose assemblies for all types of applications, ranging from fuel lines to high-pressure hydraulic lines—and with the assurance that you are getting only finest quality supplies, manufactured by Stewart-Warner. Available in complete assemblies for immediate use. Nationally distributed. See your supplier, or mail coupon for new Surgepruf catalogs.

A Full Reusable Coupling Line... Assembled to Surgepruf Non-Skive and SAE 100RI, 100R2 and 100R5 Hydraulic Hose...Without Special Tools!



Reusable Couplings and Adapters are available in a full range of thread styles and sizes for all types of hydraulic connections.

Only Surgepruf Reusable Couplings and Hose Have These Outstanding Features:

Superior Fluid Seal, with no wire braid exposure, eliminates seepage between coupling shell and wire braid.

Non-Skive Assembly provides fastest field assembly with just ordinary tools.

Superior Finish—Precision-machined steel couplings have zinc dichromate finish . . . meet rigid salt-spray testing requirements.

Full Interchangeability—regardless of hose line—Surgepruf couplings are available in any style and thread.

High Pressure Hose and Reusable Couplings. Reinforced with high tensile, two wire braid. Synthetic rubber outer cover for top resistance to hydraulic fluid, weather aging and abrasion. Available in non-skive and SAE 100R2 construction. Burst and working pressure equivalent to SAE 100R2. Available in hose ID's from ¼" to 2".

Medium High Pressure Hose and Reusable Couplings. Reinforced with high tensile single wire braid. Available in non-skive and 100R1 synthetic rubber cover, or SAE 100R5 cotton cover. Burst and working pressure equivalent to SAE 100R1 or 100R5, available in hose ID's from ¼" to 1¼".

Medium Pressure Swaged-on Hose Assemblies. Neoprene rubber-covered fabric braid hose complies with SAE 100R3 requirements. Available in hose ID's from ¼" to 1". These assemblies are made only with factory-applied steel swaged-on couplings.

Assemblies also available in one and two wire braid hydraulic hose.

Low Pressure Hose and Reusable Couplings. Reinforced with a single fabric braid. Burst pressure, 1000 psi; working pressure, 250 psi. Available in hose ID's from ¼" to ¾".

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PACKINGS

14 types of fabric, foil, plastic, and filament packings, in 9 constructions. For corrosive fluid, air, gas, water, and oil. Used on pumps, valves, valve stems, reciprocating rods and pumps, oscillating and rotating shafts, pistons, plungers, and expansion joints. Details of composition, application, and service. Temperatures to 1200 F. Sizes from 1/8″ to 1″, in 1/16″ graduations. Catalog gives lengths, weights. *Greene, Tweed & Co., North Wales, Pa.*

Circle **400** on Time-Saver Card

BALL VALVES

Round port through ball controls flow. No metal-to-metal moving parts. No galling or seizure. Constant low torque. Quarter-turn from full-open to full-closed. Flanged valves in sizes from ½″ to 10″. Screwed-end valves from ¼″ to 3″. When closed, complete shut-off at both sealing surfaces. Valve holds pressure or vacuum equally well in either direction. In wide range of metal alloys and plastics. No lubrication. Stem can be removed for repacking while valve remains in line. Abrasive particles wiped away when ball rotated to open position. Bulletin shows data sheets and summarizes them. *Jamesbury Corp., Worcester, Mass.*

Circle **401** on Time-Saver Card

DEHYDRATOR-FILTERS

For isolated, pneumatic installations requiring small volumes of compressed air. Remove moisture and oil vapor from stream. Need protection against entrainment. Low-pressure model ratings are (at 70 F) 20 scfh at 100 psig, 1 scfm at 100 psig, 4 scfm at 600 psig, 6 scfm at 1000 psig. ¼″ NPT. Shipping weight is 9 lb. Mount straight-through. No need to remove for service. Brass and bronze heads and cases. Saturation indicator changes color when cartridge needs cleaning. High-pressure model ratings are 15 scfm at 3000 psig, 25 scfm at 6000 psig. ½″ NPT. Shipping weight 80 lb. *Hankison Corp., Canonsburg, Pa.*

Circle **402** on Time-Saver Card

CENTRIFUGAL PUMPS

Single-stage, volute-type, and multi-stage pumps. Brochure lists size, performance data. integral motor, electrical data, seal options,

speed, and construction. Single-stage pumps to 70 gpm, 21 psi. Multi-stage pumps to 70 psi. Motors from ⅛ to 1½ hp. Illustrations, outline drawings, photos, and diagrams. *Eastern Industries, Hamden, Conn.*

Circle **403** on Time-Saver Card

SEALING TAPE

Chemically-inert plastic protects threaded pipe connections against leaks, even under extreme temperatures, pressures, and corrosion. 2-page brochure has samples. *Friesland Plastics Co., Friesland, Wis.*

Circle **404** on Time-Saver Card

LEAK DETECTORS

Operate by pressurizing enclosures with halogen tracer gas. Manual probe used at possible leakage points. Not for explosive atmospheres. Bulletin has formulas and examples which tell how to determine the size of leak to be detected, percent tracer gas, and test pressure. Tells how to test at higher-than-normal pressures, how to prepare system for testing. Explains leak searching procedures. Bulletin GET-2936. *Instrument Department, General Electric, Lynn, Massachusetts.*

Circle **405** on Time-Saver Card

FLEXIBLE COUPLINGS

Flexible steel disc rings transmit power, and compensate for free end float, and parallel and angular displacement. In Simplex type, rings are under rims. Unit is short and compact. Because of distance between rings, misalignment capacity is high. For ½″, ⅝″, ¾″ maximum bore, 4000 maximum rpm. Engineering Catalog 60. 48 pages. *Thomas Flexible Coupling Co., Warren, Pa.*

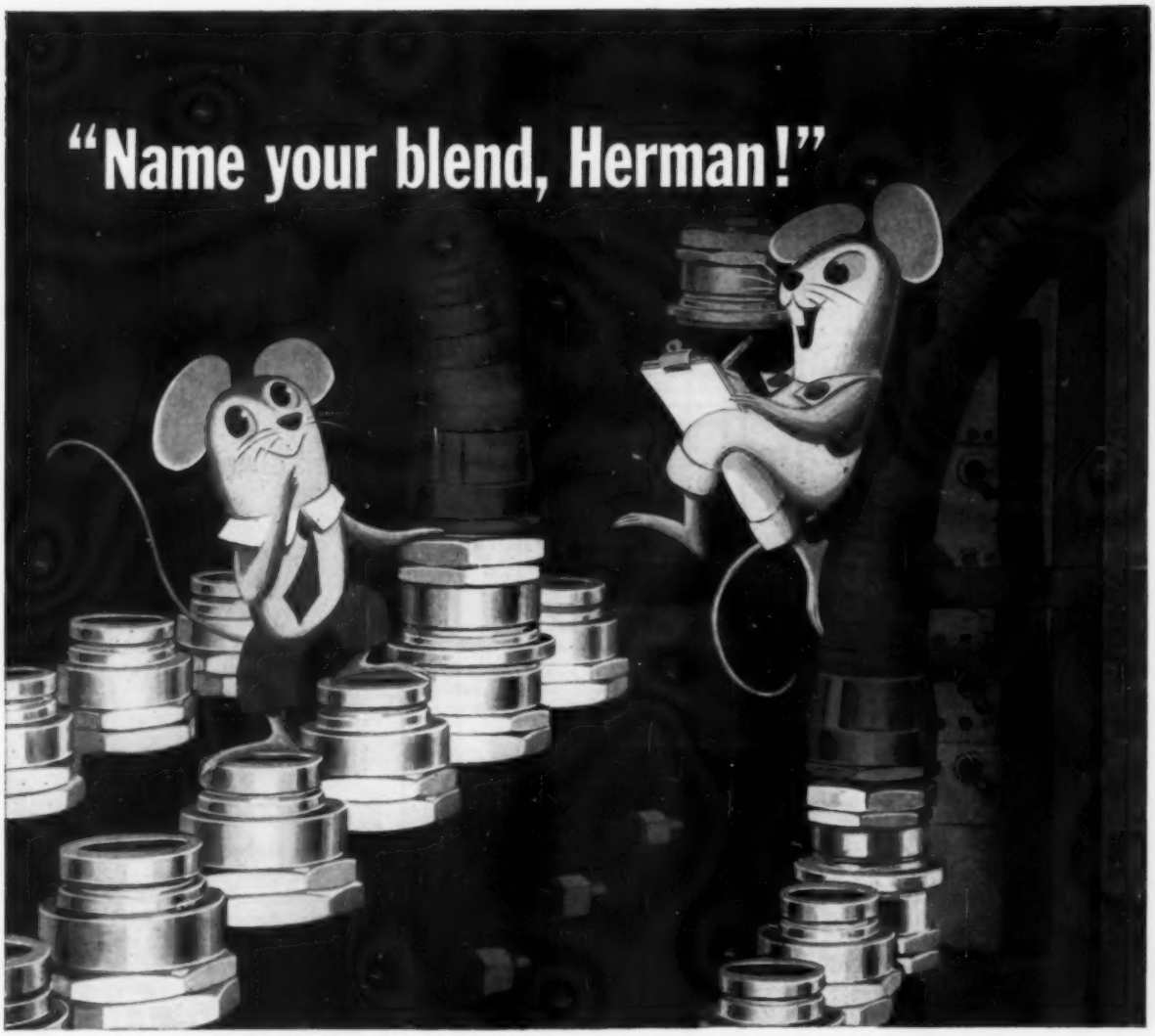
Circle **406** on Time-Saver Card

SOLENOID VALVES

Six ranges to 580 v. Flow coefficient (Cv flow factor) given for each valve, for determining flow capacity or pressure drop. Formulas for gas, liquid, steam, 2-way (NO, NC), 3-way valves, 2 and 3-way manual reset valves, special-purpose valves shown. Listed for each valve are pipe and orifice sizes, catalog number, minimum operating pressure, maximum operating pressures (for air, water, light oil, gas, and steam), stock location guide, enclosure, construction materials (of body, trim, and seat), maximum temperature rating, and shipping weight. Illustrations, flow diagrams, catalog and bulletin references. 2-way strainers covered. Solenoid Valve Stock List #506. *Automatic Switch Co., Florham Park, N. J.*

Circle **407** on Time-Saver Card

Continued on page 52



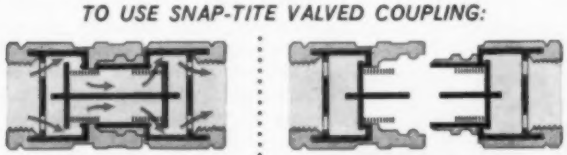
Here's the new, easy way to blend fluids: with Snap-Tite valved couplings on flexible lines

Now there's no need to laboriously open and close a lot of shut-off valves when you're blending petroleum products or other chemical fluids. With Snap-Tite valved couplings on flexible lines you can quickly switch hoses to any base stock line as required. Mixing is faster: you can perform more operations at one time . . . with no danger of contamination of base stocks by interflow through leaky valves! Valves with Snap-Tite couplings instantly shut off the flow when disconnected, and prevent run-out from overhead lines.

Under this arrangement, you store only base stocks to achieve infinite variations in blending. Not only do you save space, time and labor, but by eliminating shut-off valves and associated headers and permanent piping, you save substantially on equipment. In a recent installation (Standard Oil at Richmond, Cal.) the coupling cost was approximately one-third that of permanent piping!

For information, write for Snap-Tite Catalog No. 59. Ask for the name of your local Snap-Tite representative. There is no obligation.

TO USE SNAP-TITE VALVED COUPLING:



CONNECT—Full flow instantly

DISCONNECT—Stop flow instantly

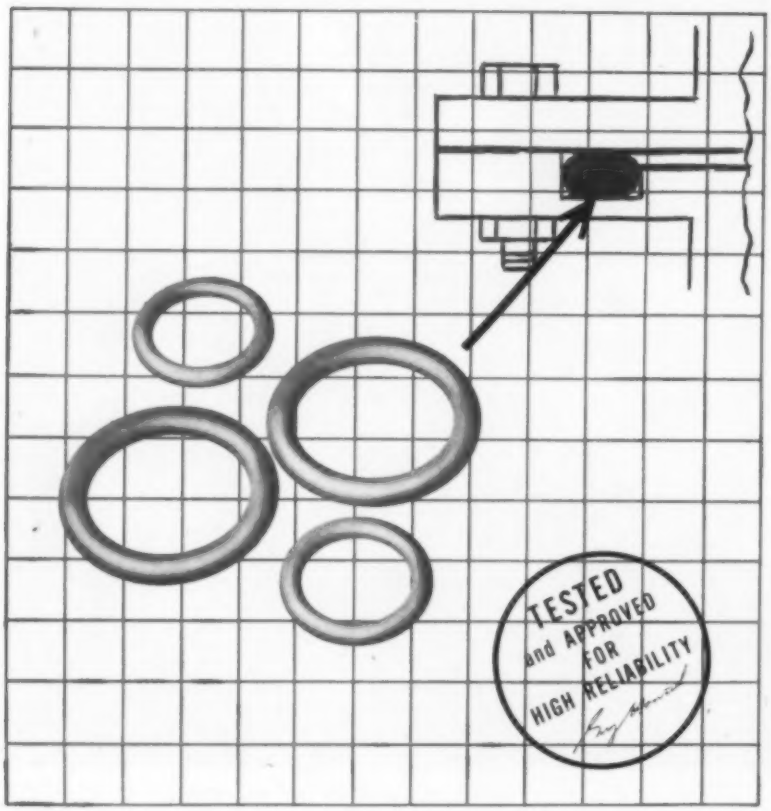
☆ Snap-tite

87-59-05

UNION CITY, PA.

R/M CAPABILITY

develops "O" rings of Teflon to resist exotic fluids and gases*



Here are compact, double-acting seals that really fit into compact designs. They are much more than just space-savers. They are resistant to extrusion, have an extremely low coefficient of friction that reduces breakaway effort on slow-moving reciprocating and rotary equipment. They have broad chemical resistance, have a servicable temperature range from -100°F to +500°F and therefore are adaptable to a wide range of applications. They are generally recommended for use as static seals.

For more information about these versatile, tough 2-way seals, write for R/M's Plastic Products Catalog.

*Du Pont trademark for its fluorocarbon resins

R/M **PACKINGS**
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N. J.
MECHANICAL PACKINGS AND GASKET MATERIALS

Circle **103** on Time-Saver Card

USEFUL LITERATURE

O-RING HANDBOOK

Engineering handbook covers design and compound information. Has latest revisions to MIL-P-5514C gland design, latest design concepts for missile and space applications. 278 pages. *Robert B. Porter Co., Glendale, Calif.*

Circle **408** on Time-Saver Card

HOSE & FITTINGS

Pictures and specifications of single and double-wire braid hose,

fittings, assemblies, adapters, and swivels. For all pressure ranges. Diagrammed assembly instructions. 8 pages. *Lenz Co., Dayton, Ohio.*

Circle **409** on Time-Saver Card

STAINLESS STEEL FASTENER SEALS

Sealing devices for bolts, studs, and other fasteners and fittings. For non-corrosive applications. In all standard sizes except —6 and —8. Catalog sheet. *Parker Seal Co., Div. Parker-Hannifin Corp., Culver City, Calif.*

Circle **410** on Time-Saver Card

AIR & OIL FILTERS

Filter tubes in cotton, cellulose acetate, dynel, orlon, nylon, jute, and glass fiber. High-temperature ceramic element available. Cartridges in fuller's earth, cellulose, cotton, and wood wool. Multi-cartridge filter for hydraulic oils. 9 cartridge types available. 10 models accommodate 1 to 24 cartridges. Filters for air and gases have rust-resistant baffle to deflect moisture. ¼" to ¾" pipe connections. Pressures to 4000 psi, flow rates to 800 cfm. Duplex filters have 2 or

4 containers. Each holds 1 or 2 tubes. Operating pressure to 125 psi. Catalog GEO-506A has photos, descriptions, and catalog references for these and other filters. 8 pages. *Commercial Filters Corp. Melrose, Mass.*

Circle **411** on Time-Saver Card

SOCKET HEAD CAP SCREWS

Meet new head design standards. All head diameters are at least 1½ times nominal body diameters. Greater under-head areas maintain greater tensile load without loss through indentation of bolted metal. Larger sockets in some sizes make possible greater tightening torques. Maximum body diameters and head heights from 0.060″ to 1″. Nominal head socket width across flats from 0.050″ to ¾″. Minimum key engagement from 0.025″ to 0.495″. Bulletin 769. *The Bristol Co., Waterbury, Conn.*

Circle **412** on Time-Saver Card

HYDRAULIC PUMPS, MOTORS, & VALVES

Cutaway drawings tell how components work. Photo, typical performance data, and JIC symbol for each component. Axial piston and vane pumps and motors, pumping units, directional control valves, check valves, electrohydraulic and pilot-operated pressure control valves, surge damping valves, flow control valves. Bulletin 220. 72 pages. *Denison Engineering Div., American Brake Shoe Co., Columbus, Ohio.*

Circle **413** on Time-Saver Card

BYPASS, RELIEF, CONTROL VALVES

For flow and condition control. Booklet explains function, application, and actuation. Gives engineering data, and range specifications. Illustrates these valves: bypass, relief, check, regulator, shutout, measuring, sequence, and special purpose. 8 pages. *United Aircraft Products, Inc., Dayton, Ohio.*

Circle **414** on Time-Saver Card

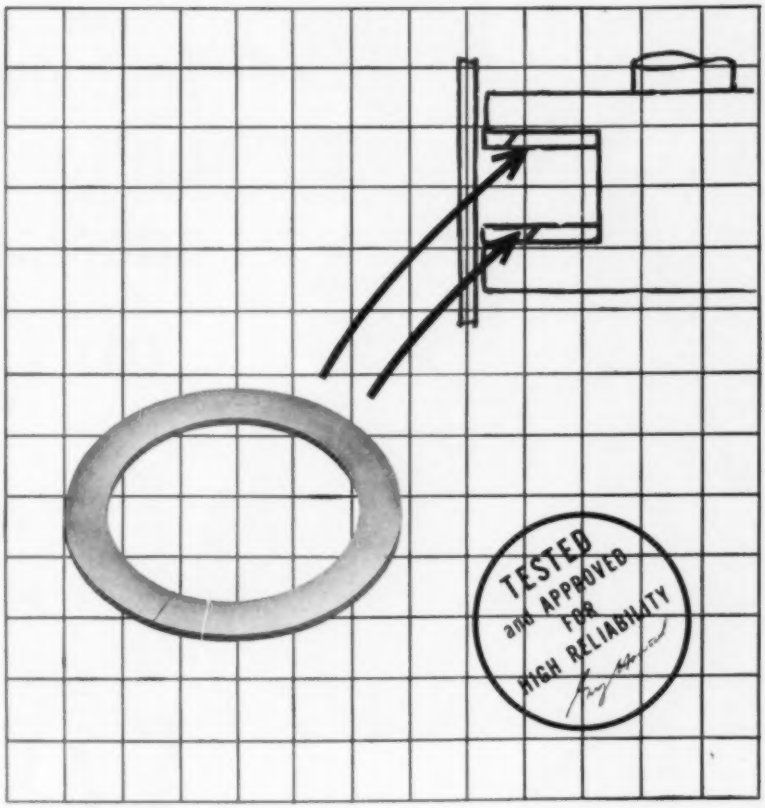
LIQUID VALVES

Nonchattering valves. Four-page bulletin gives details and specifications on sizes, capabilities, and materials. *J. E. Lonergan Co., Philadelphia, Pa.*

Circle **415** on Time-Saver Card

R/M CAPABILITY

develops back-up rings of Teflon to prevent "O" ring extrusion at pressures up to 3000 psi*



Here are back-up rings that eliminate the major disadvantage of "O" rings. They positively prevent extrusion of the "O" rings under pressures to 3000 psi, plus these benefits:

- *Low coefficient of friction*
- *Broad chemical resistance*

Precision machining by R/M assures accurate fit . . . consistent performance. Write for your copy of the R/M Plastic Products catalog. It gives complete information on R/M Teflon back-up rings and "O" rings.

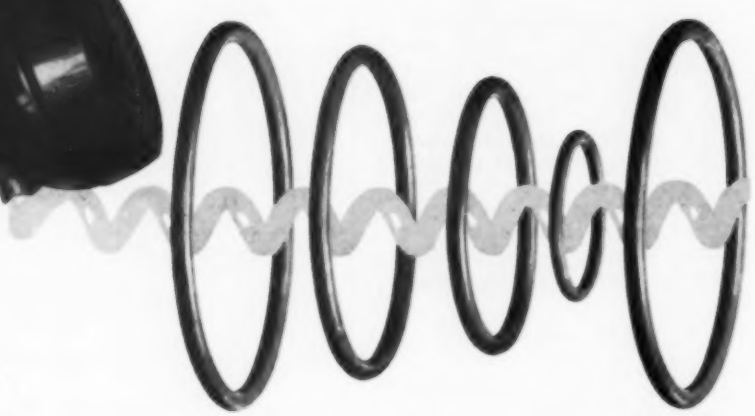
**Du Pont trademark for its fluorocarbon resins*

R/M **PACKINGS**
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, PASSAIC, N. J.
MECHANICAL PACKINGS AND GASKET MATERIALS

Circle **104** on Time-Saver Card

Call your National Applications Engineer for

engineering help
fast delivery
uniform quality
special compounds
on O-Rings



National's District Field Offices give you fast service on O-Ring engineering problems and O-Ring procurement. You talk with seasoned field engineers equipped with the latest O-Ring information and backed up by the plants of one of America's largest sealing products manufacturers. National O-Rings are precision-made, uniform in quality, specified and used by leading equipment manufacturers across America.

NATIONAL SEAL

Division, Federal-Mogul-Bower Bearings, Inc.
General Offices: Redwood City, California
Plants: Van Wert, Ohio; Redwood City and Downey, California

CALL YOUR NATIONAL FIELD ENGINEER

Atlanta 8, Georgia: George W. Smith Company, 394 Williams St., N.W., JAckson 3-7140; **Chicago (Franklin Park) Illinois:** 10013 West Grand Ave., GLadstone 5-4420; **Cleveland 15, Ohio:** 210 Heights Rockefeller Bldg., 3091 Mayfield Road at Lee, YEllowstone 2-2720; **Dallas 19, Texas:** Benson Engineering Company, 2514 West Mockingbird Lane, FLeetwood 2-7541; **Detroit 27, Michigan:** 13836 Puritan Avenue, VErmont 6-1909; **Indianapolis 5, Indiana:** 2802 N. Delaware St., WAlnut 3-1535; **Kansas City (Prairie Village) Kansas:** Benson Engineering Co., 2902 West 72nd Terrace, ENdicott 2-2843; **Los Angeles (Downey) California:** 11634 Patton Road, TOpaz 2-8163; **Milwaukee 4, Wisconsin:** 647 W. Virginia Street, BRoadway 1-3234; **Red Bank, New Jersey:** 16 Spring Street, SHadyside 7-3242; **Wichita, Kansas:** Benson Engineering Company, 519 So. Broadway, AMhurst 2-6971

6342

Steel

For many years the precise control associated with 'VSG' variable delivery hydraulic pumps and transmission gears has proved invaluable to the Steel Industry.

Mill and drawbench drives, sawing and measuring tables, processing machines and manipulators are a few examples of the many applications of 'VSG' equipment.

The Steel Industry is but one of many industries which 'VSG' has now been serving for over fifty years.

'VSG'

Regd Trade Mark

SERVING MODERN INDUSTRY

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Circle **125** on Time-Saver Card

...Along the aisles

ASTME TOOL SHOW APRIL 21-28, DETROIT

Detroit's Artillery Armory will be the scene of this year's Tool Show, sponsored by the American Society of Tool and Manufacturing Engineers. Featured will be 6000 products, of which 900 are being introduced. The 28th Annual Conference of ASTME runs concurrently.
Below is a list of exhibiting fluid power manufacturers, and products to be shown.

Booth	
847	Aeroquip Corp.
1638	Aget Mfg. Co.
1565	American Sealants Co.
1637	Beckett-Harcum Co.
1109	Bellows-Valvair
1715	Bendix-Westinghouse Automotive Air Brake Co.
1131	Browne & Sharpe Mfg. Co.
1731	Carter Controls, Inc.
238	Champion Pneumatic Machinery
420	Crane Packing Co.
935	Die-Draulic Grip, Inc.
1649	Electro-Mechano Co.
1331	Flick-Reedy Corp.
643	Flodar Corp.
1827	Gardner-Denver Co.
453	Gulf Oil Co.
2019	Hansen Mfg. Co.
943	Hause Machines, Inc.
135	E. F. Houghton & Co.
301	Hunt Valve Co.
1026	Ingersoll-Rand Co.
1815	Logansport Machine Co.
1735	M-B Products, Inc.
951	Mead Specialties Co.
1939	National Acme Co.
720	C. A. Norgren Co.
1808	Ortman-Miller Machine Co.
1915	Parker-Hannifin Corp.
1255	Ross Operating Valve Co.
1516	S-P Mfg. Corp.
1751	A. Schrader's Son
1338	Skinner Chuck Co.
707	Socony Mobil Oil Co.
515	Standard Pressed Steel Co.
1535	Stewart-Warner Corp.
960	Texaco, Inc.
1550	Thomson Industries, Inc.
1327	Tomkins-Johnson Co.
2220	Tracer Control Co.
1831	Tru-Trace Corp.
2042	Watts Regulator Co.
439	Weldon Tool Co.
1754	Wilton Tool Mfg. Co.

874 Aeroquip Corp.

You'll see . . . 2807 hose of Teflon (shown). Socketless hose. 2755 spiral-wrap, double-wire braid for high pressure. 1503 single-wire braid for medium pressure. For air, oil, and other fluids.

Circle **150** on Time-Saver Card

1565 American Sealants Co.

You'll see . . . Loctite sealant—a liquid plastic which hardens into a tough bond between close-fitting metal parts. Excess outside joint remains liquid. One drop on tightened nut wicks its way into threads, hardens, locks nut. Ordinary tools remove. Acts as liquid shim in bearings. Permits easier machine tolerances. Hardens by polymerization, not evaporation. Hardened plastic fills joint. Needs no heat, no mixing. Oil; water, fuels, and temperature extremes have virtually no effect.

Circle **151** on Time-Saver Card

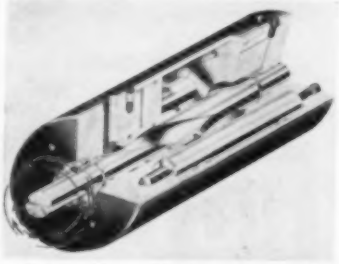
1637 Beckett-Harcum Co.

You'll see . . . all-hydraulic drill press feed control. It powers and automates large drill presses. Fast approach to work, infinitely variable feed rate. Delivers over 5000 psi drill point pressure. Console has control panel to interlock press with other units.

Circle **152** on Time-Saver Card

1731 Carter Controls, Inc.

You'll see . . . rotary torque actuators. 0 to 370 deg. rotation. Full cushioning. Powered by air, gas, water, or oil. Seals tight. Doesn't back off under tension, shock, vibration, or complete power failure. Stops at any point in cycle. Bore sizes are 4", 5", 6", 8", 10", 12". Uses include positioning, indexing, cam



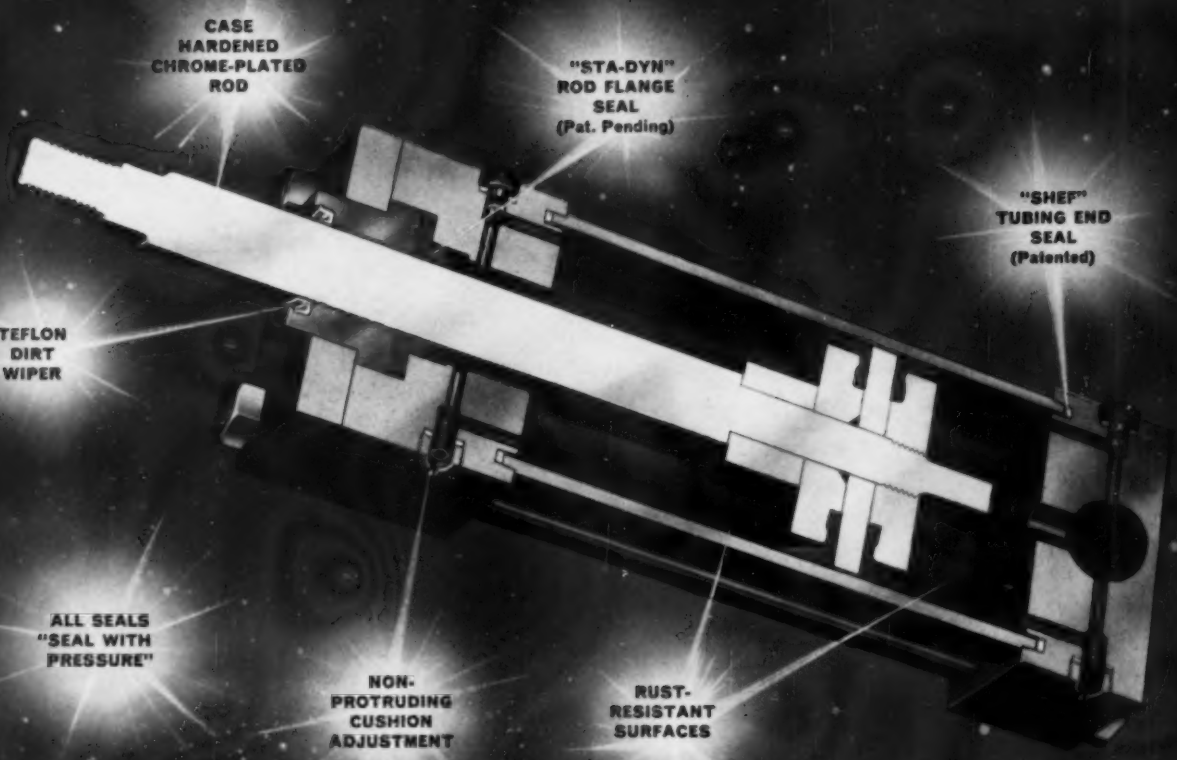
actions, valve operations, and swing motions. Rotary torque output from near zero to 15,000 in.-lb. No internal piston by-pass leakage. No external pressure loss. Available with built-in valving, attached pumps, motor, make-up reservoir, and remote poppet or solenoid valves.

Circle **153** on Time-Saver Card

Continued on page 58

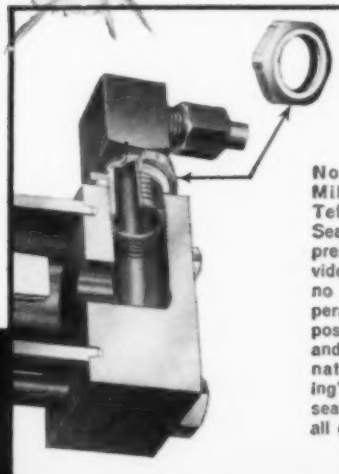
Circle **84** →

Stellar RELIABILITY and ECONOMY


CASE HARDENED CHROME-PLATED ROD
"STA-DYN" ROD FLANGE SEAL (Pat. Pending)
"SHEF" TUBING END SEAL (Patented)
TEFLON DIRT WIPER
ALL SEALS "SEAL WITH PRESSURE"
NON-PROTRUDING CUSHION ADJUSTMENT
RUST-RESISTANT SURFACES

Miller AIR CYLINDERS

PORT SEALS



Now—with every Miller Cylinder—Teflon-sealed Port Seals that "Seal with pressure" are provided as standard at no extra cost. They permit much faster positioning of lines and fittings, eliminate "overtightening" damage, and seal perfectly against all operating media.

Here are eight more reasons why Miller Air Cylinders continue to be the most economical and reliable cylinders that money can buy. These stellar features—including the new port seals—are standard Miller construction—yours at no extra cost. Thus, they provide appreciable savings in original investment—*particularly for those who insist on "J. I. C." quality throughout.* Savings in operating costs are even greater, because these features are proven assurance of longer cylinder life, greater efficiency, reduced maintenance and downtime.

Specify "Miller" for greater reliability and economy! Write for bulletin.

See Our Educational Exhibit, ASTE Show, Booth #1331

MILLER FLUID POWER

7N017 YORK ROAD, BENSENVILLE, ILLINOIS

...Along the aisles

ASTME TOOL SHOW

238 Champion Pneumatic Machinery Co.

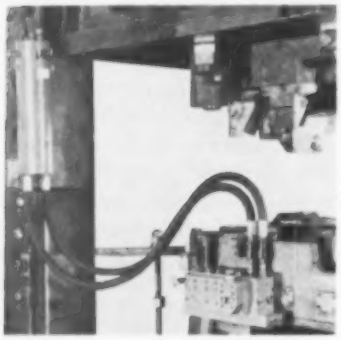
You'll see . . . Model OEH-38-60 horizontal, 2-stage air compressor. Built-in Oil Monitor has micro switch which makes

it impossible for compressor to start unless enough oil is in crankcase. 1½ hp. Displacement is 8.7 at 125 psi, 7.3 at 200 psi. 60-gallon tank. Valves are of Swedish razor-blade steel. Dome-shaped pistons fit cylinder head, allow slower, cooler running.

Circle **154** on Time-Saver Card

935 Die-Draulic Grip, Inc.

You'll see . . . hydraulic control valves. Oil recirculating type for cool operation. System pressure from small pistons within die, depressed as press

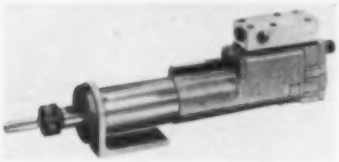


moves downward. Pressure and volume-sensitive valves hold displaced oil at constant pressure throughout stroke. Valve mounts directly to die or to manifold attached to die. Oil flows through hoses from valve to separate-mounted reservoir.

Circle **155** on Time-Saver Card

1827 Gardner-Denver Co.

You'll see . . . Tru-Thread tapper. Stationary tapper operates on lead screw.



Air motor powers tapper. Nominal capacity is 1" tap size. Produces holes of consistent Class-3 quality.

Circle **156** on Time-Saver Card

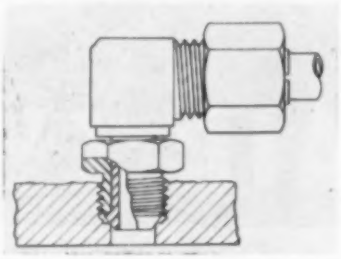
1649 The Electro-Mechano Co.

You'll see . . . air-hydraulic cylinders. Units include air cylinder with in-line hydraulic control. It has a by-pass valve and traveling cams for skip operations.

Circle **157** on Time-Saver Card

643 Flodar Corp.

You'll see . . . straight thread hydraulic port fitting. Replaces conventional pipe thread, or O-ring fittings. Close setting of high-pressure connections. Floating, threaded nut turns freely on stem of swivel body. Nut is inserted in threaded port. As it is turned, nut bears against step on bottom of stem. Further tightening forces conical end of stem against step at bottom of hole.



Stem coins its own seat, forms pressure-tight, metal-to-metal seal. Needs no swing clearance. Needs no special tools. In ¼" to 2" OD. You'll see self-flaring tube fitting. Hardened steel sleeve presses tube into contoured body. Tighten fitting to form flare, pressure-tight seal on tube's OD, ID. Sizes from ⅛" to 2".

Circle **158** on Time-Saver Card

1026 Ingersoll-Rand

You'll see . . . the RAF screw driver, which automatically feeds and runs multiple screws on a production line schedule. This and other tools will be supplied by an Ingersoll-Rand 2-stage, 125-hp XLE Compressor. It will be bolted to a concrete mat base, which will not be fastened to the floor.

Circle **159** on Time-Saver Card

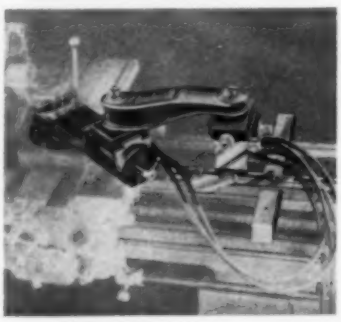
1331 Miller Fluid Power Div.

You'll see . . . SHEF (Shearproof, Heatproof, Extrusionproof, Fluidproof) cylinder tubing end seal. Air cylinder rod flange seal. Case-hardened, chrome-plated piston rods. Air cylinders with seals which seal with pressure. All-Teflon-sealed hydraulic cylinders. Air-hydraulic boosters give 10,000-psi oil pressure from shop air input. Accumulators, air-oil tank and tandem cylinder circuits, and pipe thread fittings.

Circle **160** on Time-Saver Card

1831 Tru-Trace Corp.

You'll see . . . Model Mark II tracing attachment for lathes. Install or remove this new attachment in minutes. Ready off-the-shelf. Requires no machine con-

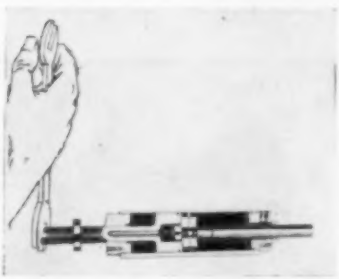


version. All-hydraulic. Pivot-type design. For both shaft and facing duplication. You'll see Synchro/Traceturn tracing attachment for turning. Duplicates 90 deg. shoulders. Uniform feed rate, regardless of shape of pattern or master.

Circle **161** on Time-Saver Card

1808 Ortman-Miller Machine Co.

You'll see . . . adjustable stroke cylinder. Turn rod to adjust stroke with micrometer accuracy. No disassembly. No



remounting. No extra parts. All steel, with bronze bearing surfaces. Port can be oriented to any position. End plugs tapped for universal mounting. For 150-psi air, 500-psi oil. 1½" to 8" bores. Standard, 2-to-1, or oversize rods.

Circle **162** on Time-Saver Card

Continued on page 60

Circle **32** ➔

Swagelok®

GOOP®

prevents galling
prevents seizing
protects valuable equipment

GOOP is the amazing new compound for ending the costly galling, seizing and resultant destruction of threaded parts.

The line includes three separate products: Blue GOOP, Silver GOOP and High Purity GOOP.

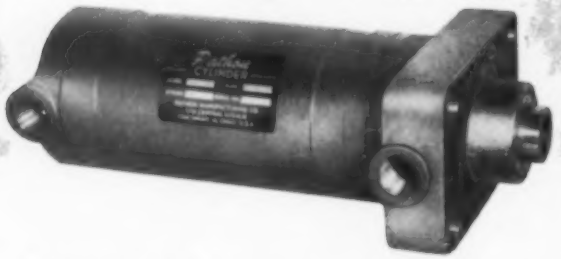
Silver Goop® is formulated to prevent seizing and galling of threaded parts, regardless of applied load, at temperatures up to 2100° F. It reduces take-up torque on threaded parts. Will not drip off red-hot surfaces nor give off poisonous metal or oxide fumes at high temperatures. Resists water washout.

Blue Goop® is an anti-seize and sealing compound for use on titanium, stainless steel, steel, aluminum and high temperature alloys. Withstands temperatures up to 400° F. Impervious to water washout, most acids and all petroleum solvents.

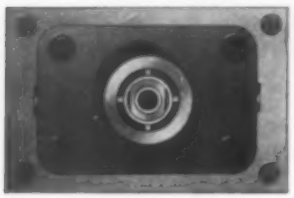
High Purity Goop® is an anti-seize and sealing compound for titanium, stainless steel, steel, aluminum and high temperature alloys. Withstands temperatures up to 400° F. Impervious to moisture, high voltage and cyclic thermal stress. Recommended for use wherever prevention of product contamination is an important factor.

CRAWFORD FITTING COMPANY
884 East 140th Street
Cleveland 10, Ohio
Crawford Fittings (Canada) Ltd., Niagara Falls, Ontario, Canada

Pathon has Something *for Everybody*



Pathon Cylinders are designed to give you a highly practical cylinder that fits into almost every situation where a hydraulic cylinder is needed. Maintenance is at an absolute minimum because Pathon Cylinders are simple and easier to take apart and put together.

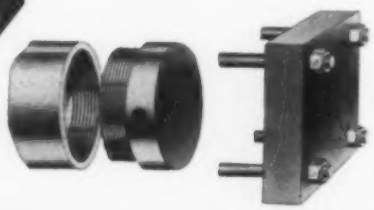


For the Designer

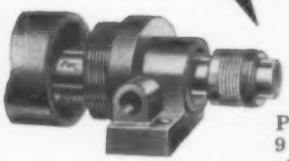
Pathon's compact design saves valuable space, makes your designing job easier, and gives your equipment added dependability with a modern rugged appearance.

For the User

Pathon's screw thread head design gives you up to 40% more strength than most tie-rod cylinders. This increased strength means less maintenance, longer life.



For the Maintenance Man



Rod packing and bearing is externally replaceable and any part can be replaced without complete disassembly and the resulting "basket full of parts."

Pathon Hydraulic Cylinders are available in 9 mounting types, thirteen bore sizes—1⅛", etc., through 14", and three Series—for 1000 PSI, and 2000 PSI and 3000 PSI.

Write for Bulletin No. 22-A

Pathon MANUFACTURING COMPANY

3823 PACIFIC AVE. • CINCINNATI 12, OHIO

FLUID OPERATED AND CONTROL EQUIPMENT

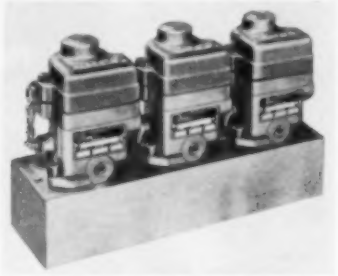
Circle **97** on Time-Saver Card

...Along the aisles

ASTME TOOL SHOW

1255 Ross Operating Valve Co.

You'll see . . . two and three-station manifolds mounted with Pacer valves. Supply line, electrical conduit, lubricator and filter serve all models. You'll

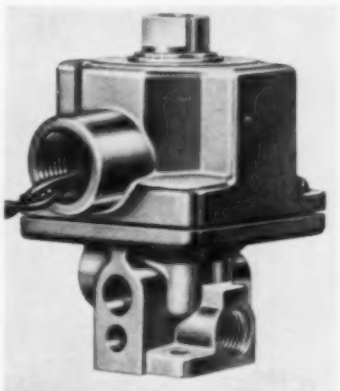


see working models of industrial air circuits, including a 5-ton press control. It features a non-tie-down valve and a single-stroke valve. Two palm-button valves operate.

Circle **163** on Time-Saver Card

1338 Skinner Electric Valve Div.

You'll see . . . new line of 3-way valves —A series, for medium-size cylinders. NO, NC. Directional control and multipurpose. Orifice sizes are 3/32", 1/8", 5/32". Body ports are 1/4" NPTF; sleeve ports, 1/8" NPT. Maximum operating pressure differentials to 250 psi. Two new L series 2-way valves. 3/4"-diameter-orifice valves have 3/4" NPTF threads. 1"-diameter-orifice valves have



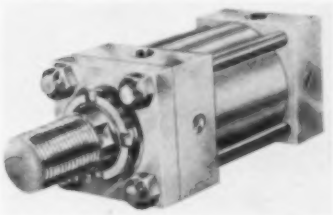
1" NPTF threads. New, R series solenoid valves. High-pressure, 2-way, NC models. 1/4"-diameter orifice, 1/4" NPTF ports. New 2 and 3-way V-5

series valves handle 400 psi maximum pressure differential. 1/32" orifices, 1/8" or 1/4" NPT ports.

Circle **164** on Time-Saver Card

1516 S-P Mfg. Corp.

You'll see . . . Model RM rotating air cylinder, for speeds to 3600 rpm. Aluminum-alloy housings and covers. Low weight, lessened flywheel effect reduce load on machine's motor. Double bearing inlet. Inlet packing adjusts automatically through working pressure.



3"-16" bores. Extra-long strokes, to actuate chucks, collets, and other rotating holding devices. Oil cylinders in 12 bore sizes from 1⅛" to 12". 23 mounting styles, 4 rod ends. For 2000 psi (3000 psi nonshock). Interchangeable cushion adjustment and check fit flush into end plates.

Circle **165** on Time-Saver Card

515 Standard Pressed Steel Co.

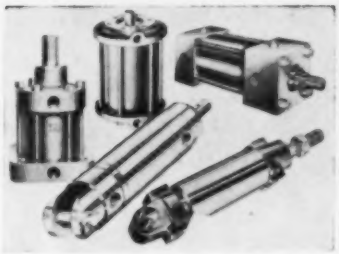
You'll see . . . 1960 Series Unbrako pHd (proper head design) socket-head

cap screw. Increased bearing area under head. To 2-1/3 times the holding power of conventional screws. No indentation of softer materials. Smooth-radius thread roots. No sharp corners. As much as 100% greater fatigue life. Nylon locking pellets for jobs where shock or vibration loosen conventional fasteners.

Circle **166** on Time-Saver Card

Use A Time-Saver Card for more information on these products

1327 Tomkins-Johnson Co.

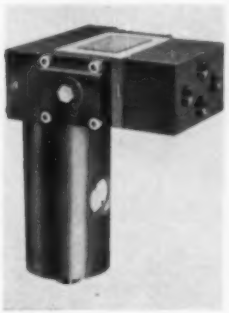


You'll see . . . a full line of hydraulic and pneumatic cylinders. Included will be the newer Squair Head and Spacemaker models.

Circle **167** on Time-Saver Card

2220 Tracer Control Co.

You'll see . . . hydraulic probe for single-axis tracing. Has hydraulic servovalve. Stable at 200-3000 psi. Tempera-

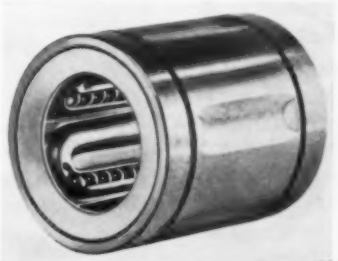


ture range from 60 to 120 F. At 1000 psi, 10-gpm model has flow rate of 2 gpm per .001" stylus deflection. Solenoid deenergize retract available.

Circle **168** on Time-Saver Card

1550 Thomson Industries, Inc.

You'll see . . . Ball Bushings for guide rods, reciprocating shafts, push-pull actions. They support any mechanism



which is moved on a straight line. Adjustable diameter and open types cover shafts from ¼" to 4" dia. Small sizes in stainless steel. You'll see nylon bearings for rotation and reciprocation, and 60 Case hardened and ground shafts.

Circle **169** on Time-Saver Card

REPLACEABLE CARTRIDGE CONTAINS INDEPENDENT INLET AND OUTLET VALVES, PISTON, RETURN SPRING AND CYLINDER SLEEVE.
HIGH PRESSURE IS
RELIABLE

High pressure systems are not new, their reliability has already withstood the test of time. Did you know that for over 10 years commercial and military aircraft have used systems operating at 3000 PSI or more, and that the hydraulic floor jack you use so often operates at 10,000 PSI?

Extra reliability is provided by the basic design of Dynex pumps. Each cartridge (piston, cylinder and valve assembly) is an independent pumping unit. The failure of one unit does not affect the operation of the others and the system will continue to operate as long as even one unit remains in operating condition. There is no danger of a sudden complete failure.

DYNEX INC.
A DEVELOPMENT OF BLACKHAWK
IS HIGH PRESSURE
777 DYNEX DRIVE • PEWAUKEE, WISCONSIN
HYDRAULIC PUMPS • VALVES • MOTORS • CYLINDERS • CIRCUITS

Circle **38** on Time-Saver Card

ADEL...offers you *single source* responsibility

for precision hydraulic power pumps

CONSTANT DISPLACEMENT GEAR TYPES WITH ELEVEN DIFFERENT GALLONAGE OUTPUTS... DESIGNED FOR 1000 PSI SERVICE WITH RATED CAPACITIES OF FROM 1.4 TO 47.5 GPM AT 1800 RPM

Precision-built for long, trouble-free service under the most severe operating conditions, they exceed the requirements for a low cost, efficient power source. Highest volumetric and hydraulic efficiency—rugged simplicity—only two moving parts—the impeller assemblies, which roll together with minimum wear and horsepower loss.

- Pumps operate at higher speeds than most competitive units and permit use of smaller pumps and motors for a given horsepower requirement, thus reducing initial cost.
- The unusual drive design of the impeller gear minimizes wear between the gear and end plates. Pumps are self-lubricated. No grease fittings to service and no external drain required.
- Special shaft seal assures positive sealing, eliminates packing difficulties. Precision gear type construction makes a quieter operating pump. Ratio of volume output to pump size unusally high.

The Pumps With Maximum Operating Efficiency Over The Years
Let ADEL be your **single-source** *for* **precision hydraulic equipment**
Write for pump brochure containing complete specifications.

NEW DIMENSIONS IN reliability

ADEL PRECISION PRODUCTS

Designers and Manufacturers of
INDUSTRIAL & MARINE
HYDRAULIC CONTROL EQUIPMENT

A DIVISION OF GENERAL METALS CORPORATION
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DISTRIBUTORS IN PRINCIPAL CITIES THROUGHOUT THE U. S. AND CANADA

Circle 3 on Time-Saver Card

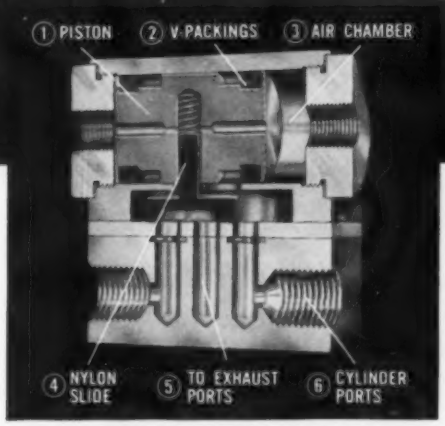

Diagram shows air flowing to one side of a double acting cylinder from outlet 6 while being exhausted through hole 5 on other side of cylinder. When the right poppet is touched, air is bled from chamber 3 and piston(1) is shifted to right. At this point, air is exhausted through port 6 as air enters opposite side of cylinder.

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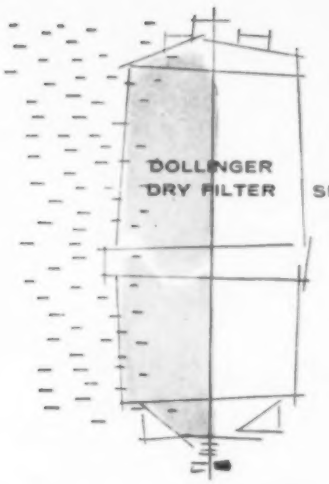

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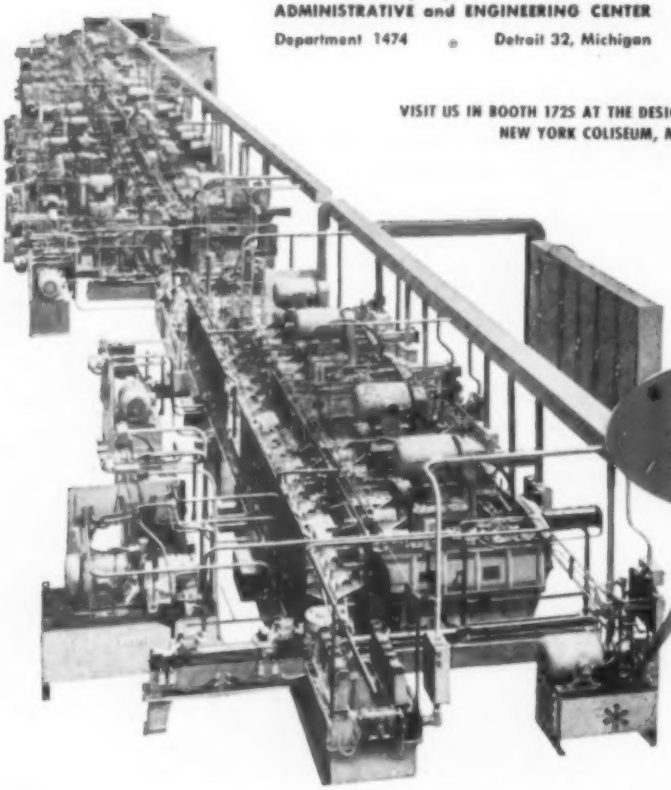

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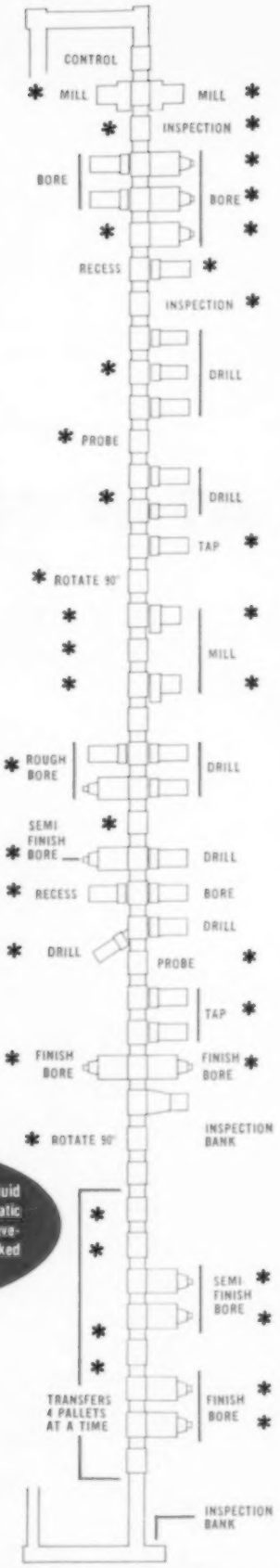

APPLIED Hydraulics & Pneumatics
APRIL 1960

PLASTIC LINES can they meet your fluid power needs?

An APPLIED HYDRAULICS & PNEUMATICS *staff report*

"WHAT can it do for me?" That's the question that designers ask when they learn of a new product or a new material. If the answer is encouraging, they go on to investigate whether it will do a job better or cheaper than what they're using.

The editors of APPLIED HYDRAULICS & PNEUMATICS thank the following companies who contributed technical information for this article.

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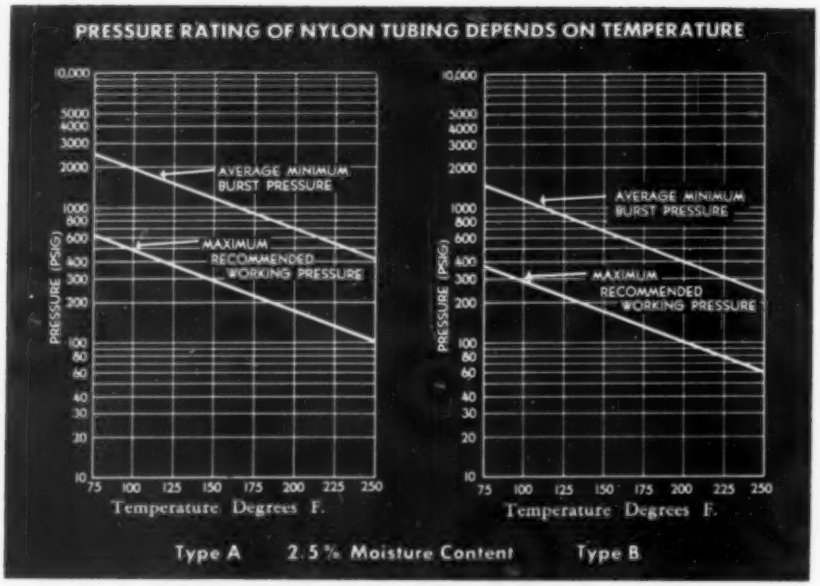
The Polymer Corp., Reading, Pa.
Production Feeder Corp., Mentor, Ohio
Remmele Engineering Co., St. Paul, Minn.
The Weatherhead Co., Ft. Wayne, Indiana

Plastic hose and tubing has already made the grade for many applications, and is under investigation for many new ones. Though it has been available for a number of years, new requirements in fluid power design, and new developments in hose make these materials worth study for compressed air and hydraulic jobs.

Hose and tubing for fluid power applications are being extruded from three basic plastics: nylon, polyethylene, and polyvinyl chloride (vinyl). Each has its own advantages (and disadvantages) for particular jobs. This article will acquaint you with properties of these materials and tell you what sizes and ratings you can get now. New developments are being made rapidly. Several of the products described in this report have been put on the market in the last few months.

• **A word of caution**—Reputable manufacturers of plastic hose and tubing are putting their biggest sales emphasis on overcoming damage done by scrap dealers. There's a big scrap market in vinyl, poly-



ethylene, and even nylon. This reused material does *not* have the quality characteristics of virgin plastics. Nylon, in particular, because of its high, sharp melting point, requires special processing for uniform properties, and to prevent random brittleness.

So when you select plastic lines, pick your supplier carefully. It's always worth paying for quality. You may be willing to chalk it up to experience when your $3.19 plastic garden hose springs so many leaks it looks like a soaker. But it wouldn't be so funny if a defective air line shut down production in your plant.

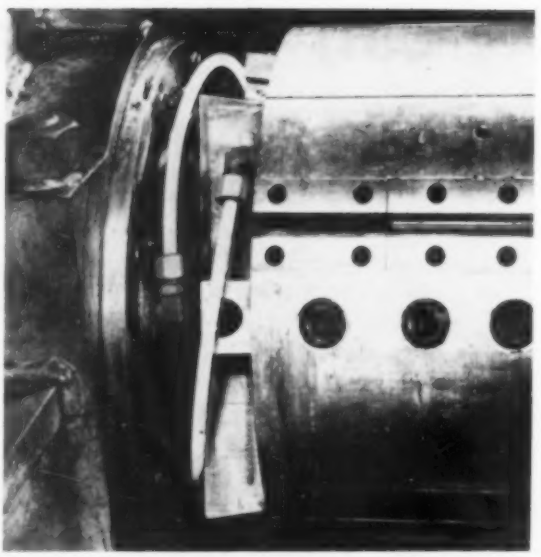
• **Nylon Tubing**—Unreinforced nylon tubing is being used for flexible lines on machine tools at lower hydraulic pressures and for air lines, often to replace copper tubing. It has excellent flexural strength. It has good impact and abrasion resistance, does not become brittle in storage. Nylon is not affected by hydraulic fluids, either petroleum base or the various fire resistant types. Temperature rating ranges from —100 F to 225 F.

• **Pressure Rating**—Nylon has high burst strength per unit weight compared to metals and other plastics. However, burst strength is affected by temperature and moisture conditions, and each application should be analyzed to determine tubing performance. Burst strength is lowered by increasing temperature or moisture content of the tubing.

As long as fiber stresses are under 4000 psi, nylon seems immune to fatigue. For continuous flexing, fiber stress can be limited to this figure by keeping bend radii greater than 10 times tubing OD.

In one test, ¼-in. tubing pressurized between 700 and 1000 psi flexed over 1½ million times without failure. The tubing had a bend radius of 4¾ in. and one end was stroked 3 in. at a rate of 2½ cps.

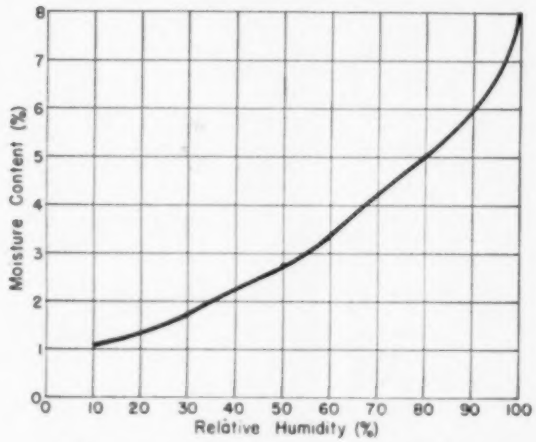
Nylon resists crushing better than copper tubing. An impact of 32 ft-lb on a 5/16 in. OD tube with an .035-in. wall reduced ID by 20% to 25%. An impact of 10 to 12 ft-lb on a ⅜-in. copper tube completely closes it.



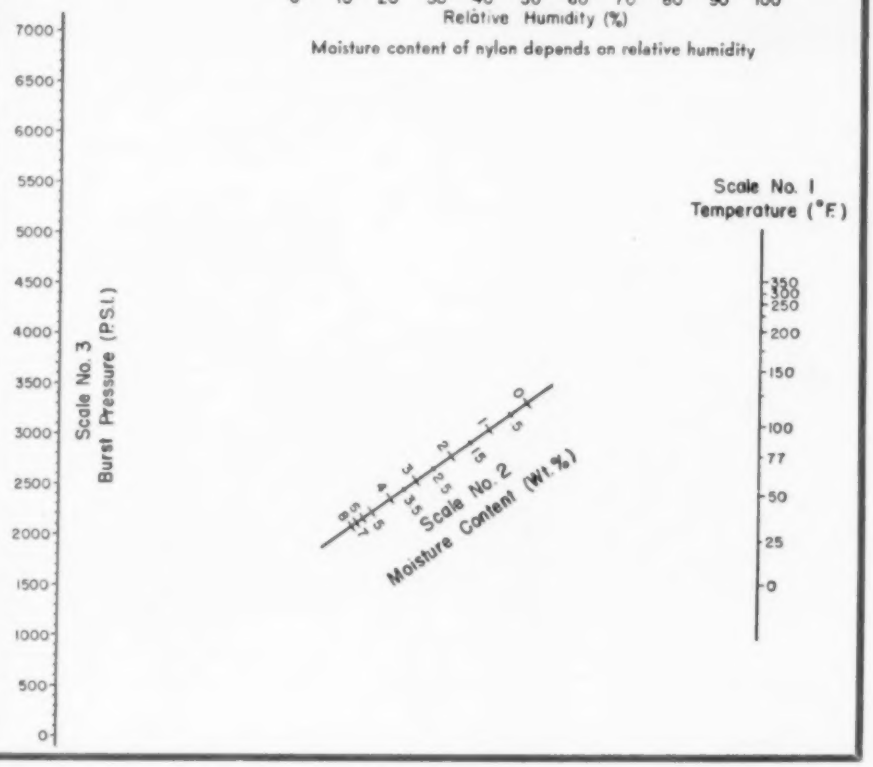
WINDING REEL FOR STEEL STRIP has a hydraulic gripper which holds strip during winding. Nylon tubing has replaced steel and withstood impact and mechanical abuse better. Pressure is 600 psi, 1000-psi peaks. Oil temperature is 150 F. Flare fittings are used.

• **Installing Nylon Tubing**—Nylon is easily cut with a knife and flared with a hand tool. It can be used with standard metallic compression and flare fittings designed for metal tubing. Flare fittings should not be used where large temperature changes

COMPUTE NYLON TUBING BURST PRESSURE FROM THIS NOMOGRAPH



Moisture content of nylon depends on relative humidity



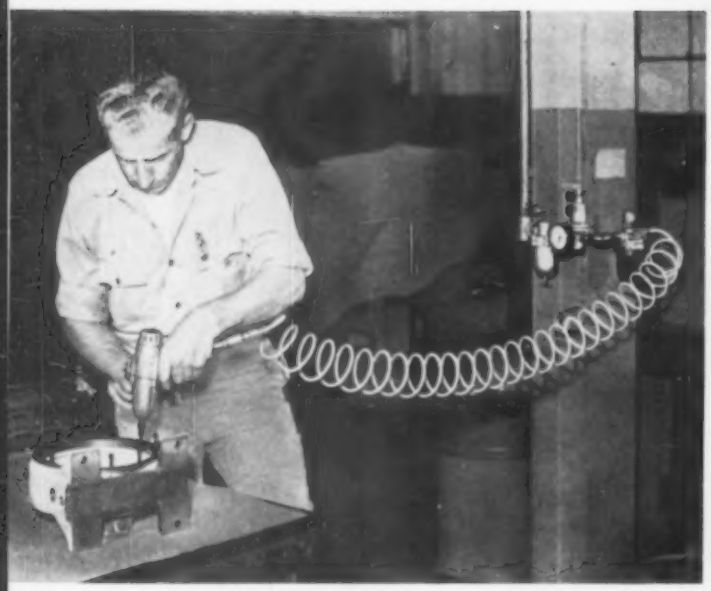
A moisture-content curve and a nomograph can be used to calculate burst strength of one type of nylon under various temperature-moisture conditions. First use the curve to find moisture content for the particular relative humidity. Using this figure on scale 2 and the temperature on scale 1, a straight line intersects scale 3 at the corresponding burst strength.

The moisture-humidity chart is for nylon 6. Nylon 11 which is also used for tubing has a maximum moisture absorption of 1.8% at 100% humidity and 194 F.

NYLON TUBING SHORT TIME BURST RATING *

	1000 psi					2500 psi				
OD - in.	1/8	3/16	1/4	5/16	3/8	1/8	3/16	1/4	5/16	3/8
ID - in.	.096	.138	.190	.242	.295	.078	.110	.150	.188	.225
Minimum Bend Radius - in.	5/8	1	1¼	2	3	3/8	5/8	1¼	2	2½

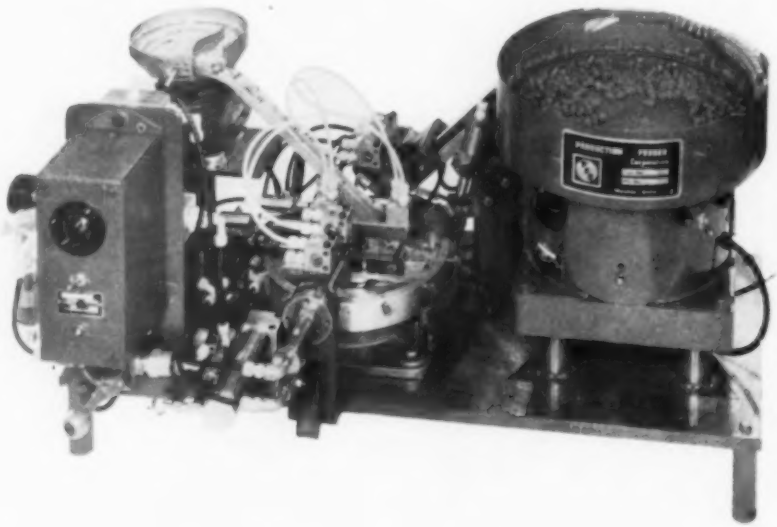
*Pressure applied at 1000 to 1500 psi/min. Ratings are for ambient of 75 F, 50% relative humidity. (Tubing contains approximately 2½% water.)
Table based on tubing supplied by The Polymer Corporation



COILED NYLON TUBING makes a self-storing air line. The lightweight line extends to 20 ft, is rated for pressures to 200 psi.

NYLON FLARE FITTINGS connect nylon line on air-operated tooling. They are installed fast with ½ to ¾ turn after finger tightening. Nylon fittings compensate for flow tendencies of tubing, have better breakaway torque at temperatures above 75 F.

POLYETHYLENE TUBING makes a neat job on this pneumatic machine to assemble valves for aerosol cans. Designers at Production Feeder Corp. like it for compactness, quick assembly.

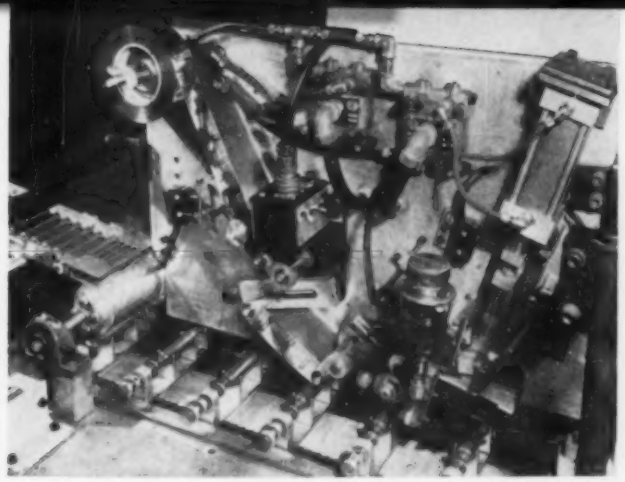


occur frequently, because the difference between thermal expansion of the metal fitting and nylon tube may loosen the joint. A 45-degree flare fitting having a nylon nut and brass body overcomes this difference in thermal expansion. It is recommended for pressures to 250 psi.

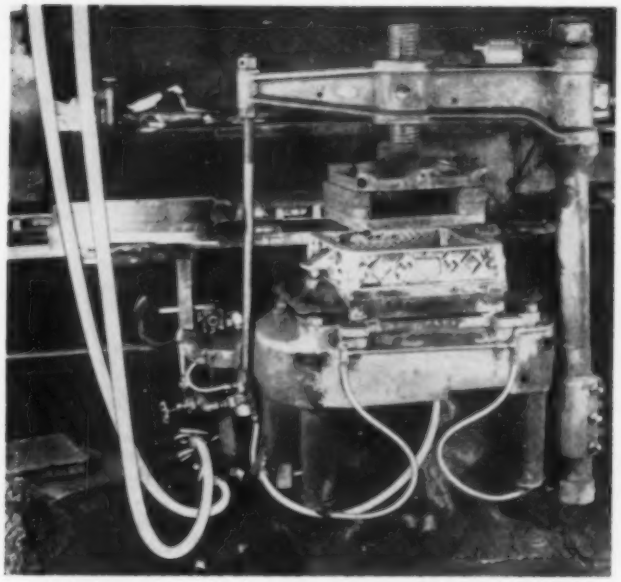
Nylon tubing may have wider tolerances than metal, and you must take care in using compression fittings. They should be self-aligning to prevent misaligning the ferrule when the tubing OD is on the small side of the tolerance. There is also a new fitting with a resilient sleeve which holds the burst pressure of the tubing even under varying temperatures from —65 F to 275 F. Another popular fitting is an all-nylon compression type.

• **Reinforced Nylon Hose**—A recent addition for applications requiring flexible hose, this has a nylon inner tube, reinforced with a high tensile yarn, and an abrasion resistant nylon cover. It is available to meet SAE 100R1 specifications for single wire-braid rubber hose in pressure ratings shown in the table.

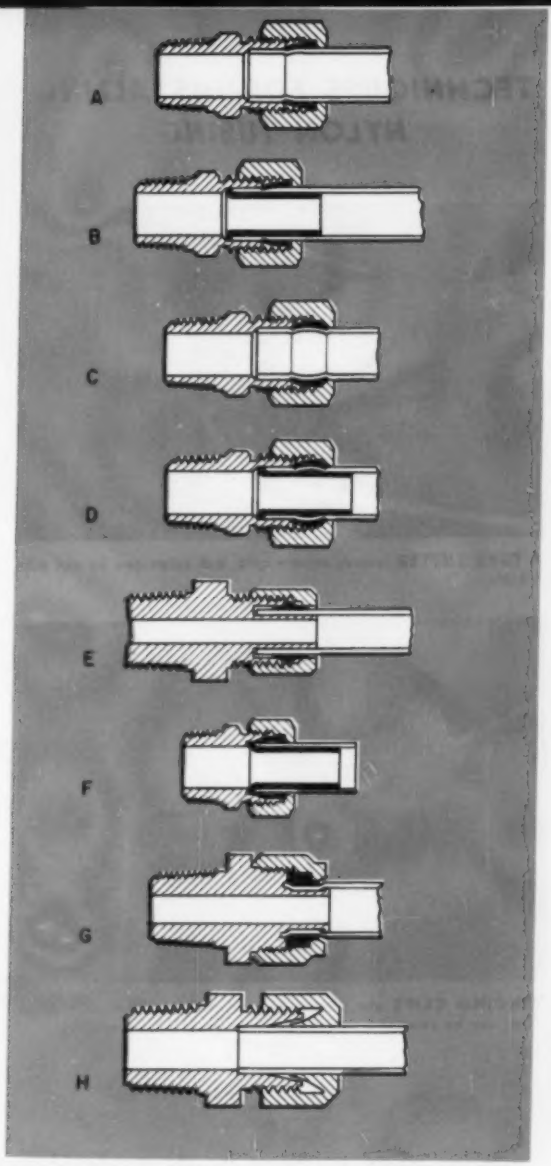
Nylon hose has excellent flexural strength and one type rated for 1250 psi operating pressure has been flexed 1,171,000 times while pressure pulsed to 2500 psi without failure. The hose is very light and has this plastic's characteristic resistance to abrasion and impact. The host can withstand torsion and works at temperatures from —65 F to intermittent 300 F. It is available in lengths of 500 ft. and longer depending on



LABELING MACHINE designed by Minnesota Mining & Manufacturing in cooperation with Remmele Engineering, uses polyethylene tubing for its air system. Brass fittings have a plastic sleeve to distribute stress on the tubing.



VINYL AIR LINES ON THIS MOLDING EQUIPMENT are rated for 125 psi through the temperature range of 10 F to 160 F.



COMPRESSION FITTINGS for use with plastic lines. Internal sleeve can be used to support soft plastics.

hose size.

Reusable fittings are available in:

- Male pipe thread
- Male, 37-degree flare
- Male, 45-degree, flare
- Female, 37-degree, swivel
- Female, 45-degree swivel
- Flareless swivel
- Bent tube ends with 45-degree and 37-degree flare swivel

Ready made assemblies with swaged fittings are also available.

• **Polyethylene Tubing**—Made from ethylene gas (a petroleum product) solidified under high pressure,

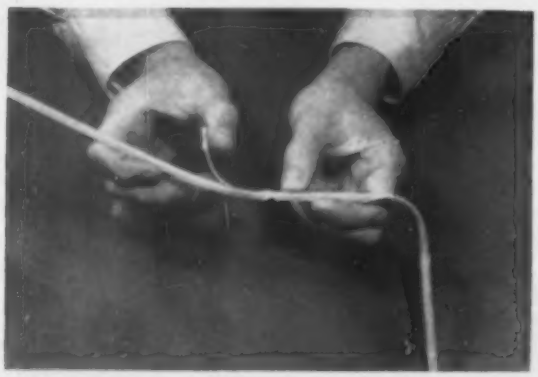
REINFORCED NYLON FLEXIBLE HOSE SPECIFICATIONS

Dash No.	ID - in.	OD - in.	Minimum Burst Pressure - psi	Minimum Bend Radius - in.
	1/8	.235	8000	1.75
—4	3/16	.335 .406	8000 12000	2.25 2.50
—5	1/4	.415 .455 .500	5000 8000 11000	2.50 2.50 2.75
—6	5/16	.460 .563	5000 10000	3.00 3.25
—6R	3/8	.560 .585 .625	5000 8000 9000	3.50 3.50 4.50
—8	13/32	.688	9000	5.00
—10	1/2	.710 .820 .781	5000 8000 8000	4.50 4.50 6.00
—12	5/8	.938	6000	8.00
—12R	3/4	1.094	5000	9.50
—16	7/8	1.188	4500	11.00
—16R	1	1.281	4000	12.50

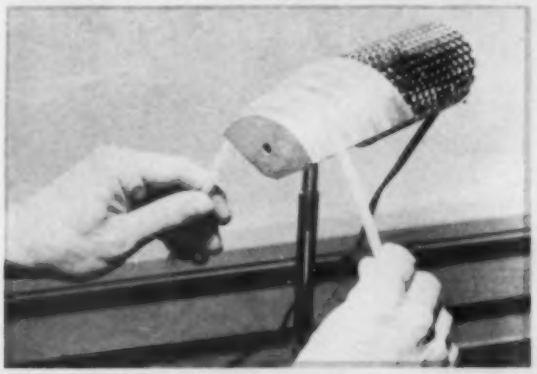
TECHNIQUES FOR INSTALLING NYLON TUBING

A TUBE CUTTER insures square cuts, but nylon can be cut with a knife.

FLARING TOOL allows for nylon's "memory" and overflares for a final 45-degree angle. Hot flaring is recommended if tubing is to be stored. It can be done in production with a spinning form.



BENDING CLIPS are snapped on to make a 90-degree bend. They can be removed and the tubing rebent for other jobs.



HEATED BENDER makes permanent bends. It has several grooves for different size tubing. Tubing is then cooled in water. Tubing can also be heated in 300F oil and bent with a standard tube bender.

this has gained acceptance for air and liquid lines. Temperature range is —60 F to 175 F.

Compression fittings are used with polyethylene tubing. An insert may be used to prevent tube collapse. A brass fitting has been developed for polyethylene tubing. It has an integral support for the tubing. A plastic sleeve distributes stresses on the tubing.

• **Polyvinyl Chloride**—One specially formulated vinyl tubing specially designed for air lines extends the common temperature range for 125-psi operation. It is tested for minimum burst pressure of 600 psi and is recommended for temperatures of 10 F to intermittent 160 F, although there is some loss in flexibility below 30 F. Vinyl is the most elastomeric of the plastics used for pressure hose and tubing. It has excellent abrasion resistance. Because of its internal smoothness, it can pass a higher air flow than comparable steel or copper tubing. A 3/16-in. ID vinyl hose equals ¼-in. steel or copper tubing in this respect.

Vinyl tubing can be used with compression tube fittings designed for plastic hose. Reinforced hose for pressures to 2000-psi working pressure is under development. The reinforcement will be an integral part of the hose. ▼▼▼

POLYETHYLENE TUBING SPECIFICATIONS

OD - in.	1/4	5/16	3/8	1/2	5/8	3/4	1
ID - in.	1/8	3/16	1/4	3/8	1/2	9/16	3/4
Minimum Burst Pressure-psi (70F)	600	480	405	300	240	210	300

VINYL TUBING SPECIFICATIONS

OD - in.	3/8	1/2	3/4	1
ID - in.	3/16	9/32	3/8	1/2
Calculated air flow - SCFM	27.4	58.7	159.6	347.0

FIG. 1. ASSEMBLED PUMP has an integral relief valve with separate return port.

The Kingsbury slipper pump . . . design for higher pressures

• By **JAY M. ROTH** and **DONALD L. ROTH**
Mechanisms Co., Urichsville, Ohio

This variation of vane pump design has been tested up to 2400 psi and indicates it can be rated beyond that. The only close tolerances in manufacturing it are on length dimensions which can be easily held by surface grinding. Wear on the loaded surfaces does not increase leakage.

WE HOPED to improve the performance of a vane pump by using low friction, Kingsbury[1] slippers at the outer face of the vanes. We gave the vanes enough freedom to pivot, so that they could build up a Kingsbury type fluid film to support them as they slide on the cam ring. They can tilt in the rotor slots so that their outer faces fit the cam ring contour and always make area contact instead of line contact.

The slippers need not fit the slots with clearances closer than .006". The dotted slipper at *D* of Figure 2 shows that it's shaped so it cannot turn over or wedge.

• **Improve on Earlier Design**—Most earlier slipper pumps had a slipper radial travel of only about 5% of the rotor diameter. That made the pump bulky. It also made the load on the journal bearings so large

[1] *Named after the inventor of the Kingsbury thrust bearing which this pump resembles in some ways.*

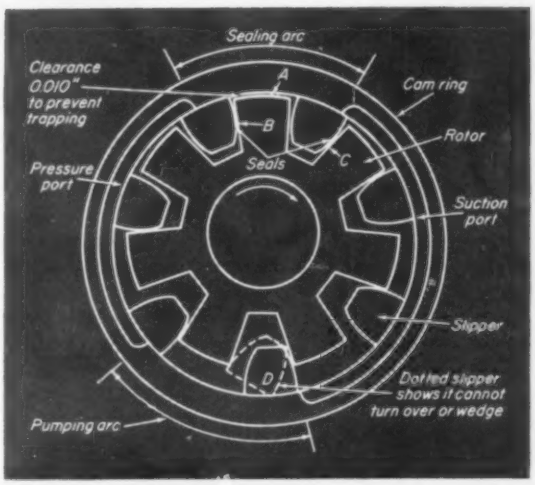


FIG. 2. BASIC DESIGN of improved Kingsbury slipper pump.

that it reduced efficiency and severely limited the maximum practical pressure.

We set our slipper travel at least 10% of the rotor diameter. Figure 2 shows the general proportions. A liberal clearance of about 0.010 in. between rotor and cam ring prevents trapping. The seal between the pressure and suction ports is made by pressure forcing the slippers forward against the leading faces of the rotor slots at *B* and *C*.

While the slipper is passing the pressure or suction port, there is no pressure difference across the slipper to hold it against the cam ring. It is held in place by a combination of forces. One is centrifugal force, which we calculated as small for the pumps we built. Another force is the cohesion of the oil film. Springs are not needed.

To take care of end clearance, we pressure loaded the end plate to a fixed clearance so that it can move back to let dirt particles pass. This pump will work with dirt particles in the oil because none of the fixed clearances are as close as 0.001 in.

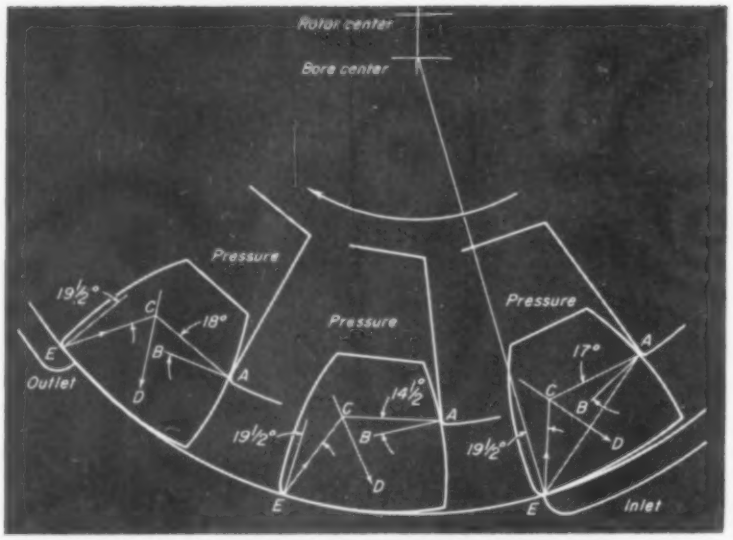


FIG. 3. FORCE ANALYSIS, SLIPPERS RIDING ON LEADING EDGES.

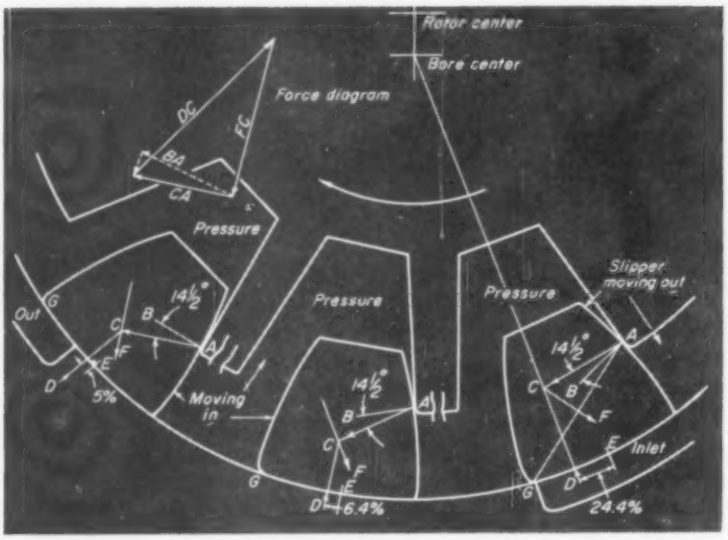


FIG. 4. FORCE ANALYSIS, SLIPPERS SEATED.

• **Pump Analysis**—Life tests on our first pump showed considerable wear on the leading edges of the slippers. To investigate we drew Figure 3. It shows the location and direction of forces on the slippers when they are riding on their leading edges. The magnitudes of the forces are not shown. The idea was to arrange the forces so the slipper would not ride on its leading edge. The principle used is the Direction Condition of Equilibrium. It says that three forces acting on a body in equilibrium must intersect at a single point.

A slipper riding on its leading edge would scrape through the oil and rub the metal. A reasonable friction coefficient for metal on metal is 0.35 (tangent 19.5°). Thus force *EC* in Figure 3, between the leading edge of the slipper and the cam ring is shown at 19.5°. *CD* is the resultant of the hydraulic force acting on line *AE*. *AB* is the normal force that the rotor would exert on the slipper without friction. Since *CD* and *EC* intersect at *C*, we know from the Direction Condition of Equilibrium that the third force *AC*, which comes from the contact with the driving rotor must intersect at *C* also if the slipper is to remain in equilibrium riding on its leading edge.

Because of the slow relative motion and plentiful lubrication at *A*, we assumed that the friction coefficient is .25, so the corresponding angle will be just under 14.5°. As long as angle *BAC* exceeds or equals 14.5°, there is not enough friction at *A* to hold the trailing edge of the slipper away from the cam ring, so the slipper will seat properly instead of riding the leading edge as drawn. Originally we made angle *BAC* only 10° minimum. The pump was satisfactory with steady flow, but it was very sensitive to the slightest amount of air in the oil, or to pulsations fed back from a large hydraulic system. Reducing the

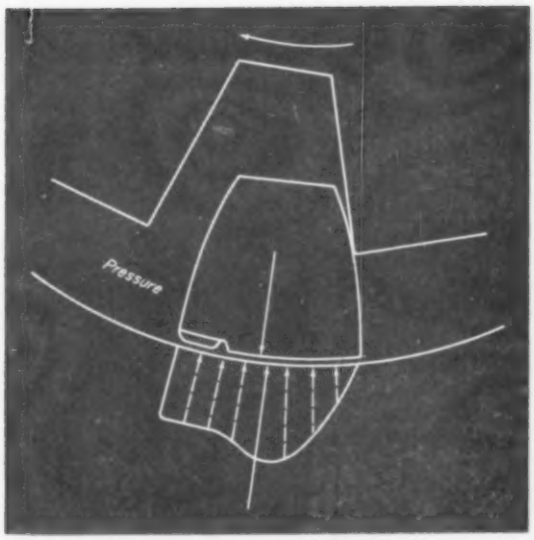


FIG. 5. OIL GROOVE AND CHAMFERED EDGES insure pressure oil under slipper's leading edge.

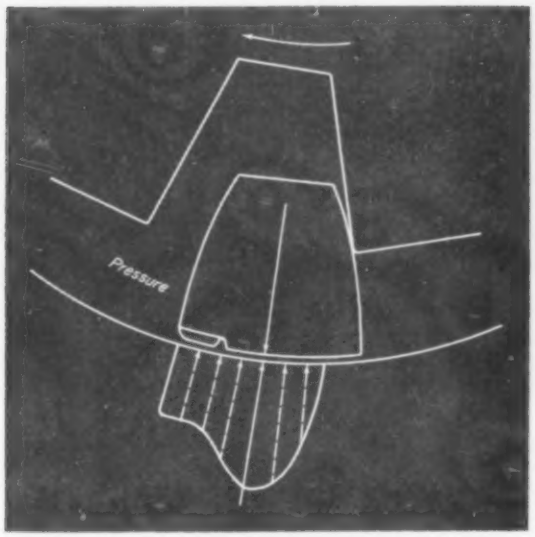


FIG. 6. MAKING SLIPPER RADIUS SLIGHTLY LESS than cam ring permits discharge pressures to at least 2400 psi.

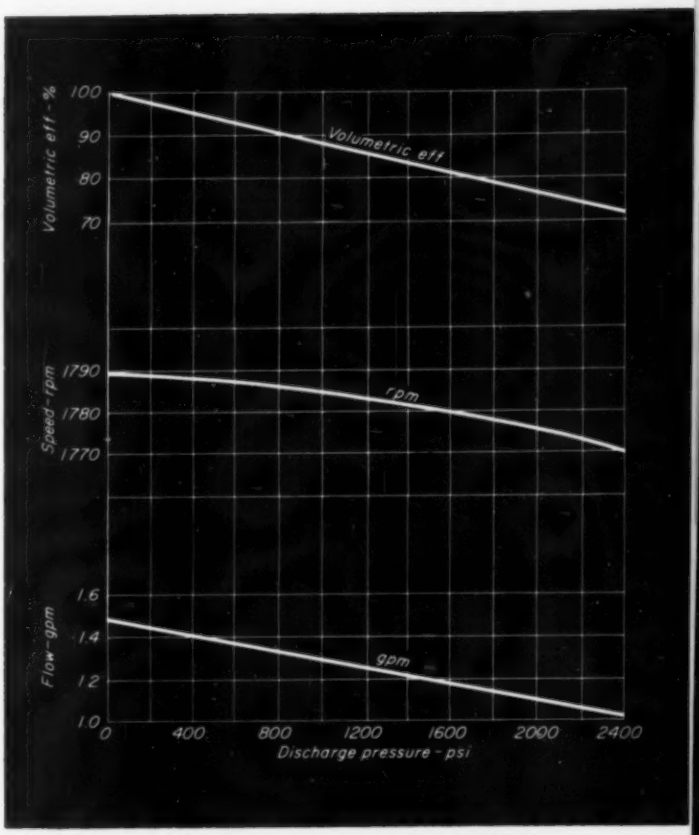


FIG. 7. PERFORMANCE OF THE KINGSBURY SLIPPER PUMP.

angle to 7° minimum made the pump distressingly noisy, but with a 14.5° minimum the slippers did not ride their leading edges under any operating conditions.

We are now assured that the slippers will always be seated on the cam ring. Figure 4 shows where and how the forces act on the seated slippers in the pumping arc. *AC* is the force exerted on the slipper by the rotor. Its direction is changed by 14.5° by friction away from the normal force *AB*. The direction of change depends, of course, on whether the slipper is moving in or out. The rotor force *AC* and the hydraulic force *CF* intersect at point *C*. Then by the Direction Condition of Equilibrium, the resultant bearing pressure on the outer face of the slipper must pass through *C* also. This resultant, *DC*, is drawn radially from point *C*, since we expect to have a friction coefficient of about 0.002, so the friction angle would be negligible.

The resultant *DC* is 24.4% ahead of the center of the slipper contact area with the slipper moving out, and only 5% to 6.4% ahead with the slipper moving in. In developing the theory of Kingsbury slipper action in their "Engineering Applications of Fluid Mechanics," Hansacker and Rightmire show that when the slipper is parallel to its mating surface, the resultant bearing load is in the center of the slipper,

Concluded on page 98

Limit horsepower with

• By **R. N. CORDREY**, *The National Supply Co., Torrance, Calif.*

and **REX C. BURNHAM**, *Manager Hydraulic Div. J. N. Fauver Co., Detroit, Michigan*

Horsepower consumption of a hydraulic system is a function of pressure and flow. If you increase pressure, you've got to decrease flow proportionally to limit the power you're taking from an engine. You can do this automatically with double pumps in a hi-lo circuit.

UP MAST! It's raised through a cable system powered by a fluid-motor-driven winch. Two double pumps which power this operation also supply pressure fluid for actuating the power tongs of this oil well service rig.

HYDRAULICS does two jobs on National Supply's oil well servicing rig, and they're each very different. First, the mast has to be erected by a fluid-motor-driven winch. Second, the power tongs make or break pipe connections when putting pipe into the well or taking it out.

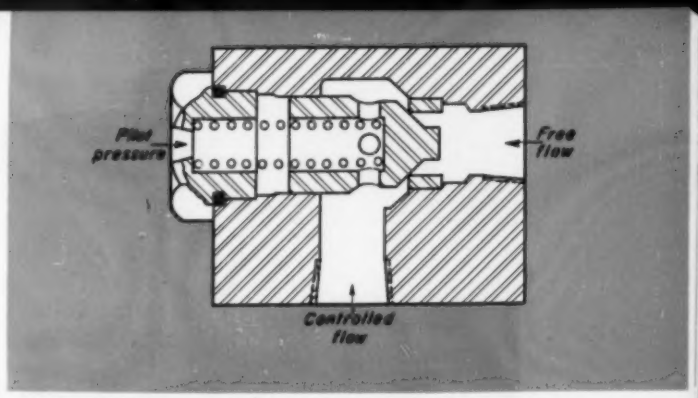
To erect the mast, 45 gpm must be supplied at pressures to 2000 psi to the winch fluid motor to rotate it at 1200 rpm. Engine speed during this operation is 1350 rpm, and maximum power consumption is 54 hp.

The power tongs operate with the engine idling. Power consumption must be limited to 12 hp for safe speed and torque. Total pump output at the 700-rpm idle speed is 20 gpm. A pressure-compensated, flow control valve installed in the power tong circuit limits flow to 20 gpm regardless of pressure. This prevents dangerous tong speed if the engine is accidentally speeded up.

At load pressures to 1000 psi, each pump delivers from both its sections. At 1000 psi, an unloading valve connected to one section of pump *A* (see circuit diagram) opens and bypasses that flow to tank. At 1200 psi, an unloading valve bypasses flow from a section of pump *B*. The remaining 19 gpm from both pumps is then directed to the tongs at pressures from 1200 psi to 2000 psi. By cutting flow to one-half in the higher pressure range, power is kept under the 12-hp limit, and the tongs operate at half speed in the high torque range.

• **Full horsepower for winch**—When operating the winch, all four sections of the pumps deliver to the fluid motor. To raise the mast, design pressure is 2000 psi. Actually, 1500 psi is sufficient. As the mast erects, required pressure drops. Winch pressure is

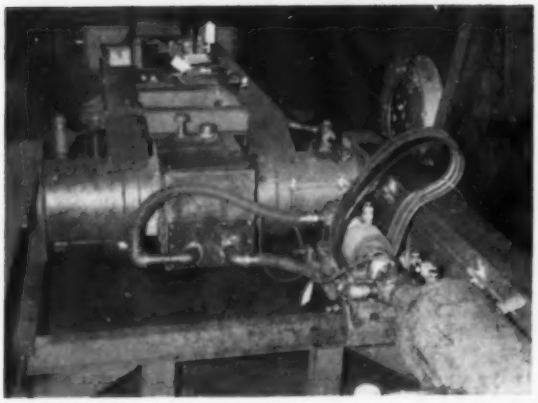
double pumps



CHECK VALVES have been modified for pilot operation. Pilot pressure acts on larger area than system pressure and holds valve closed.

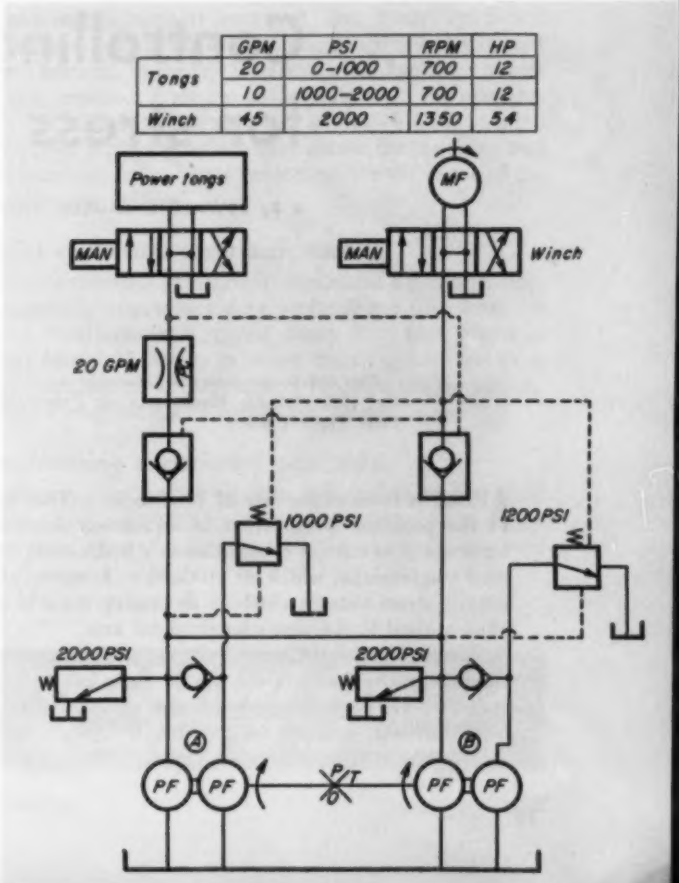
Courtesy Double A Products Co.

FLUID MOTOR DRIVES the mast winch through a 6.62:1 chain sprocket ratio and 31.9:1 worm gearing. Maximum pull on the cable is 29,700 lb with 2000 psi on the motor, based on 25% winch efficiency.



TRUCK CHASSIS looking forward shows the hydraulic pump and reservoir installation. Pumps are driven by six V-belts. Reservoir acts as a torque-tube between the narrow front-end beams and the wide frame which supports the drawworks.

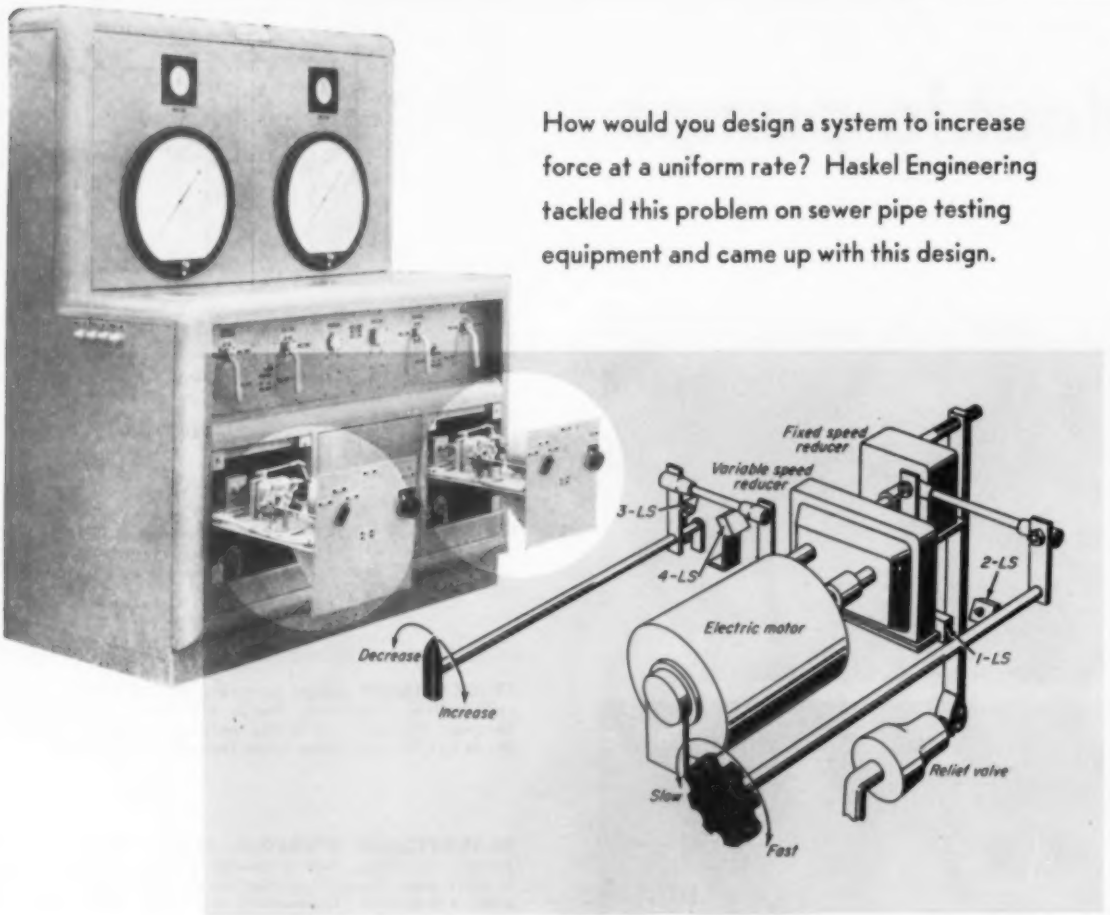
PILOT-OPERATED HYDRAULIC SYSTEM supplies flow at pressures indicated. Fluid is directed to either the power tongs or winch motor by pilot-operated checks which close when pilot pressure is applied. Open-center, directional valves unload the system during idle periods.



connected through pilot lines to the unloading valves. This pressure assists the valve springs and holds them closed as pressure rises above 1000 psi.

The engine is speeded up to 1350 rpm to deliver the 54 hp required for this operation. The engine may be operated at low rpm if the operator wants the mast to erect slower. At 45 gpm, the mast can be fully erected in 3½ min.

Both the power tongs and the winch motor are controlled by open-center, 4-way valves which unload the pumps when neither the tongs nor the motor is working. The pumps are connected together, so that both can supply either operation. Pilot-operated check valves in the lines to the tongs and motor close off either of these when the other is operated. These special valves close when pilot pressure is applied to them. ▼▼▼



How would you design a system to increase force at a uniform rate? Haskel Engineering tackled this problem on sewer pipe testing equipment and came up with this design.

Controlling pressure rate for stress testing

• By **EDWARD E. LAUREN**, *Field Engineer, Haskel Engineering & Supply Co., Glendale, California*

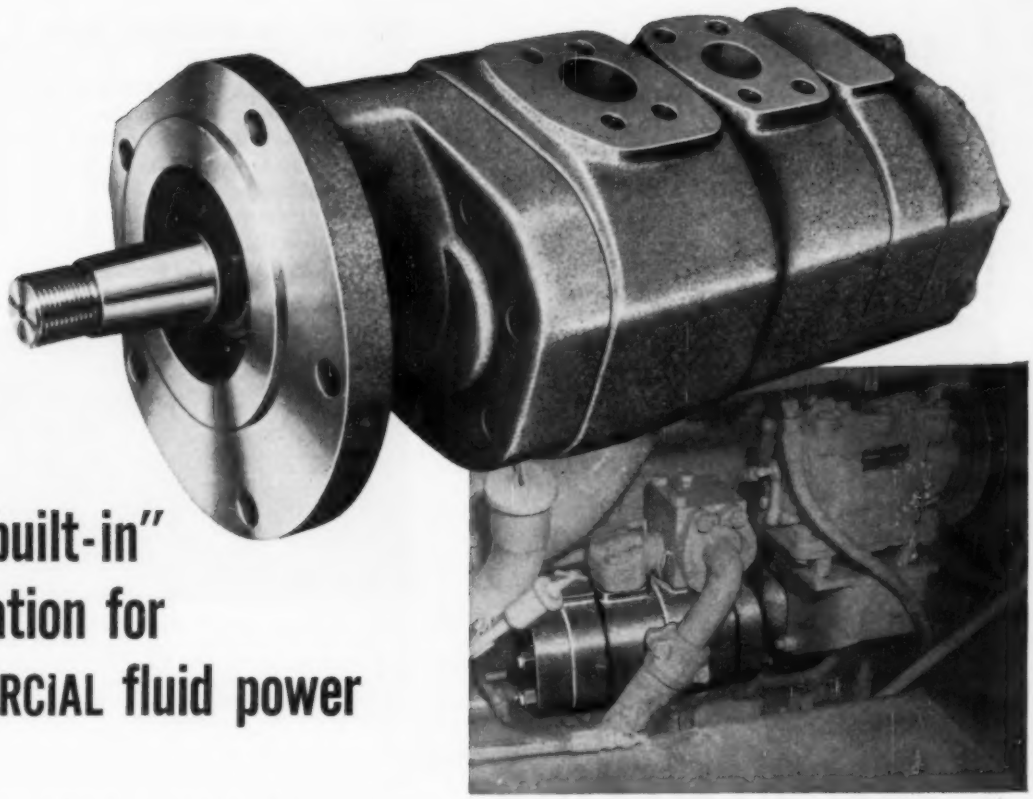
This article was awarded honorable mention in the 1959 APPLIED HYDRAULICS & PNEUMATICS *Prize Paper Contest.*

APPLY a force at the rate of 2000 lb/min. That was the problem specification in equipment designed for sewer pipe testing. In addition to a hydrostatic test, local communities, which set up the specifications, also require stress tests in which an increasing force is applied normal to the pipe's longitudinal axis.

Two stress presses were built as part of the test equipment. One has a 5-in. cylinder, the other an 8-in. cylinder. To meet the requirement of 2000 lb/min force increase, pressure on the smaller cylinder must increase at the rate of 102 psi/min, and on the larger one at the rate of 39.8 psi/min.

• **Mechanism adjusts relief valve**—The system varies pressure by adjusting a relief valve. To do this, a 1/12-hp motor drives a screw through a variable speed reducer and a fixed speed reducer. A nut traveling on this screw actuates a lever, which in turn applies force to the relief valve spring and adjusts its setting. Setting of the adjustable speed reducer is made through a linkage controlled by a knob on the tester's front panel. A second knob on this panel is linked to the reducer's reversing control, so that the relief valve can be adjusted either up or down at a variable rate.

Continued on page 80



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Model 95	73 gpm @ 1500 psi	18.4 gpm @ 1000 psi

"95" Payhaulers on the go—Model H pumps under the hood.

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COMMERCIAL pumps are mounted under the hood on right-hand side of engine, directly below the air compressor. Pump shaft is coupled to the Payhauler's engine crankshaft through its front gear train. Pumps are 5-bolt flange mounted direct to matching flange opening in gear train housing. In the few instances when hydraulic power is not required, a simple cover plate seals the opening. Gained: Clean cut power plant design—logical position simplifies piping, provides easy access for servicing and maintenance, plus better protection for the heart of the fluid power system.

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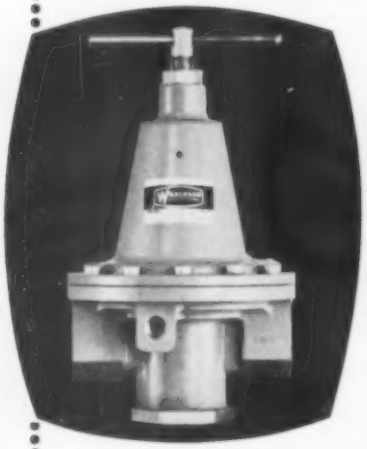

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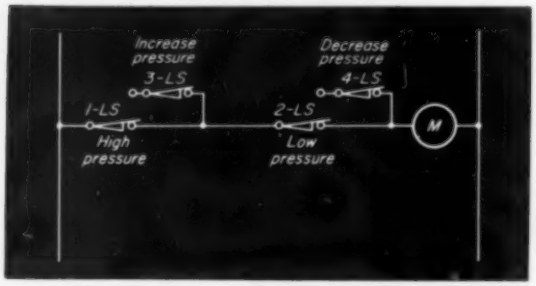
Four limit switches on the pressure controller are actuated by the increase-decrease switch and the lever which controls relief valve setting. These limit switches are connected to shut off the motor at either extreme setting of the relief valve.

Range of the variable speed drive is 0 to 431 rpm in either direction. This gives the tester a force-change rate of ⅓ to 4 times the required rate. It also permits returning to zero pressure quickly after a test, and lets the pipe manufacturer make accelerated tests.



LIMIT SWITCH CIRCUIT shuts off the motor at either extreme of relief valve setting. Switches 1 and 2 are actuated by the lever which adjusts the relief valve. Switches 3 and 4 are actuated by the increase-decrease selector. The circuit permits decreasing pressure after reaching the high pressure limit, or increasing it after reaching the low pressure limit.

Although the rate of force change is not perfectly linear, because of the valve's spring characteristic, it is close enough in the 100-psi to 1500-psi range in which the tester works.

• **Pump, accumulator solve problems**—In the original design of this equipment, one power unit with a 15-gpm pump supplied both the hydrostatic testing requirements and the stress testing system. Hydrostatic pressure was held by a 5-gal piston accumulator for 30 minutes or more. Most of this time pump delivery flowed through a solenoid-operated, 2-way valve controlled by a pressure switch sensing accumulator pressure. When accumulator pressure dropped, the 2-way valve closed and the pump charged up the accumulator pressure. Surges caused by this valve operation interfered with the stress force, and a separate 1-gpm pump had to be installed to supply the stress system independently.

Another trouble encountered in this development was an erratic pressure drop as force was applied. The large pressure gage indicating pressure on the stress cylinders would hesitate and drop slightly three or four times during a test. The drop was about 30 to 50 psi for the 8-in. cylinder and 10 to 25 psi for the 5-in. cylinder.

The reasoning was that the stress cylinder moved at an extremely slow rate and was chattering because of seal break-away friction. As it moved forward, it temporarily required more oil than the pump could deliver. Thus the drop in pressure. An accumulator installed at the cylinder smoothes out these pressure variations by providing a constant supply of pressure oil. ▼▼▼

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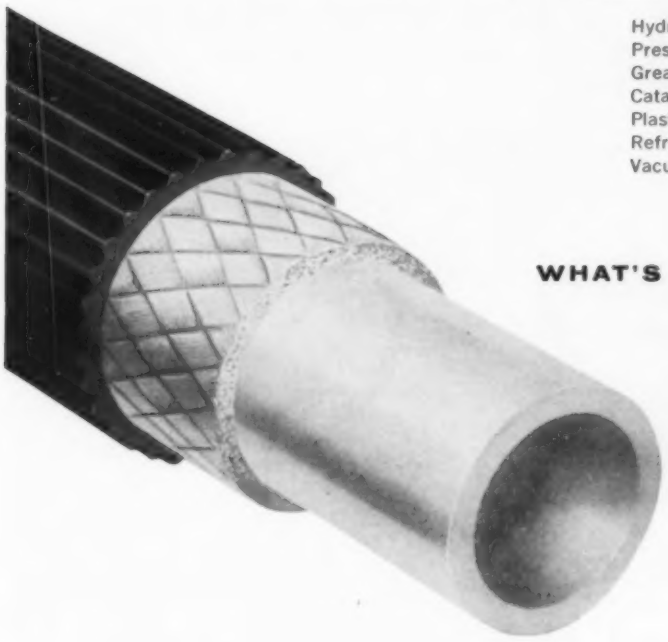

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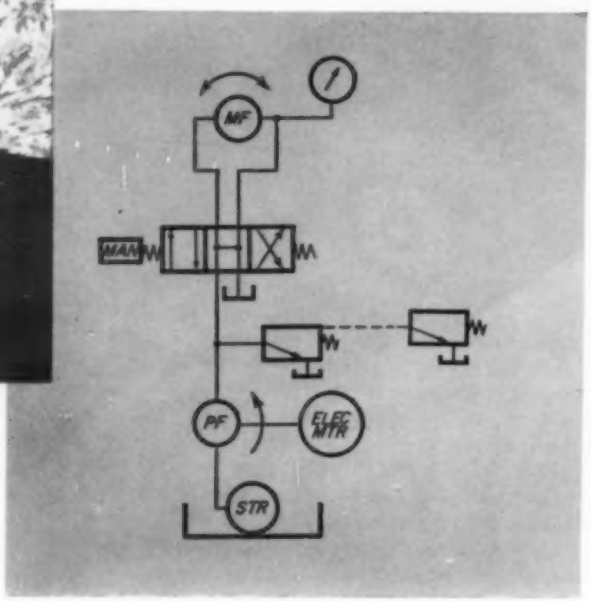
Fluid motor speeds torque test

• By **ALLAN STEEL**, *Scovill Manufacturing Co., Waterbury, Conn.*

TORQUE TESTER for electric wire connectors. A clamp holds the ends of the connector stationary. A fixture attached to a fluid motor, applies torque at the center. The gage is calibrated in lb-in.

Here's a fluid motor torque tester that can be operated by a woman. It replaced a spring-loaded torque wrench that required a man's strength. Both speed and accuracy were improved.



AN OPEN-CENTER CONTROL VALVE unloads the pump when the tester is not being used. Fluid motor torque is regulated by a remotely-controlled relief valve.

WHEN the production of electric wire connectors increased at Scovill, their engineers had to devise a faster, less fatiguing and more accurate method for torque testing the connectors. They had been using a spring-balance torque wrench. The operator read the force in pound-inches from a dial on the end of the wrench. This method was slow and readings were not accurate enough. A machine had to be designed.

Test settings of the machine had to be infinitely variable because of the varying torque requirements on the different size wire connectors. The answer was a simple hydraulic circuit using a fluid motor to develop the torque.

An open center circuit was used to keep heat and power requirements low. An adjustable remote relief valve regulates the pressure setting of the main system relief valve. The operator changes torque by turning a small handwheel which varies the setting of the remote relief valve.

System pressure registers on a 0 to 3000 psi pressure gage. Its dial is also calibrated in pound-inches. The tester applies up to 2400 pound-inches torque.

To test a connector, it is placed in a fixture in the center of the machine. A stationary clamp lowers over the fixture. The operator actuates the 4-way valve to direct fluid to the hydraulic motor. System pressure is increased by rotating the handwheel on the remote relief valve. Connectors can be tested to a specific torque, or to their breaking point.

▼▼▼

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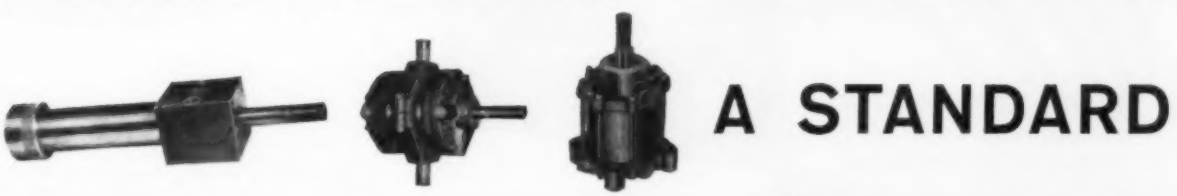

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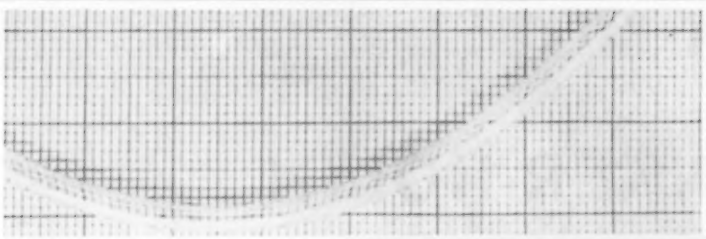

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A three-way air valve which is easily changed to give either normally open or normally closed operation simplifies flash welder design.

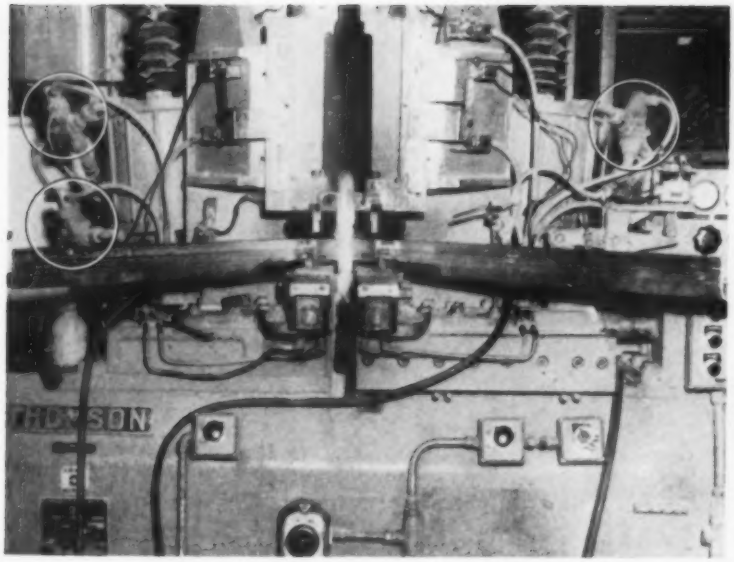
Close-

CLAMPING on a flash welder is speeded by pilot-operated, solenoid-controlled valves, close coupled to the clamp cylinders.

Up to 6000 aluminum window frames can be made in one day at General Bronze's Alwintite Plant at North Dighton, Mass. To get this production, they installed a mitre flash welder made by Thomson Electric Welder and equipped with special pneumatic controls. Alwintite workers can now make about 160 mitre welds an hour depending on the operator.

The welder has a normally-open valve controlling air to one side of each clamping cylinder and a normally-closed valve for the other side. The same 3-way valve is used for each. Merely rotating the valve's pilot section 180 degrees changes it from normally-closed to normally-open.

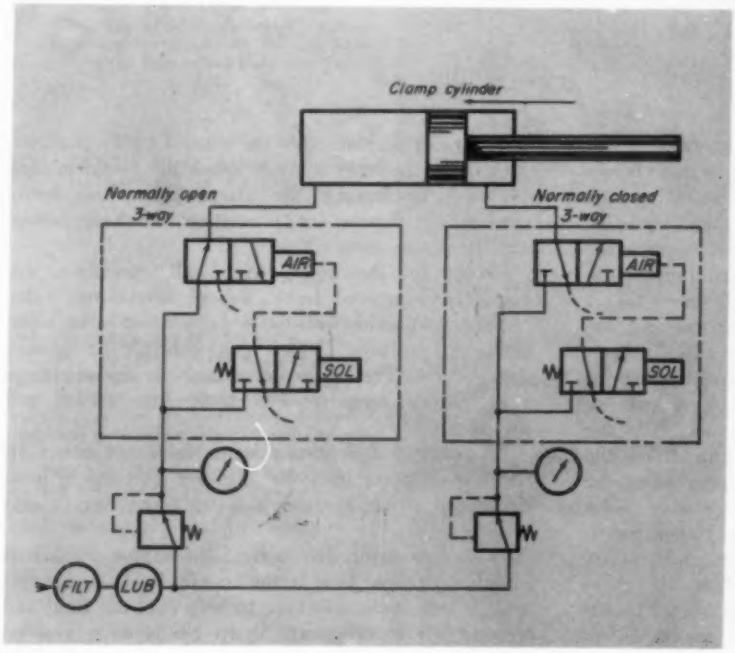
The pilot section has no exterior pneumatic connections. Pilot air comes through a $\frac{1}{8}$-in. passage from the inlet side of the main valve to the bottom of the solenoid plunger. When the solenoid moves the plunger, air flows by the plunger through another passage to the

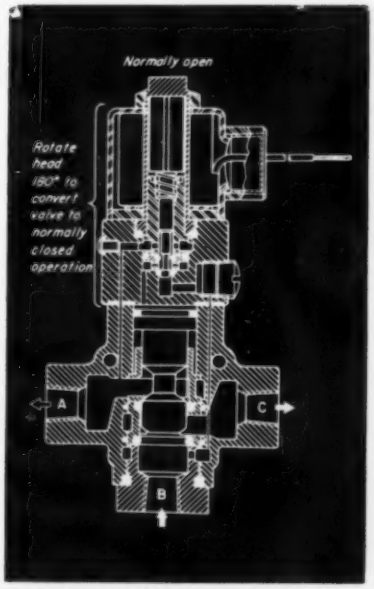


CLOSE COUPLING THE AIR VALVES (circled) to the clamp cylinders on this flash welder gives fast operation.

coupled air valves speed welding

top of the main valve spool, forcing it down. Depending upon which port is inlet and which is exhaust, the valve opens or closes. There is no long flow of pilot air since it is right at the solenoid. Short plunger movement of about ⅛ in. plus the short, pilot-air line, produces an extremely high-speed spool response. ▼▼▼





MAXIMUM POWER consumption of the ½-in. valve is 10 watts. Chambers on the outside of the spool guide permit full flow through the valve.

Courtesy Airmatic Valve, Inc.

BOTH NORMALLY OPEN AND NORMALLY CLOSED VALVES are needed in this clamp circuit. Using an easily converted valve simplifies stocking.

One valve controls four operations

● By **RUSSELL W. HENKE,** *Russ Henke Associates, Elm Grove, Wis.*

ONE 4-way, 4-position, spring- centered valve is the master control for agitating cement in transit, hoisting the mixer body, actuating the cement chute, and opening the discharge gate on this equipment, made by S & M Mfg. Co. of Milwaukee. The driver can operate any of these functions simultaneously from either the cab of his truck, or the rear fender platform.

At the job site, the driver stops the truck and unfolds the chute into the discharge position. He can then control the discharge gate, hoist, and cement agitation.

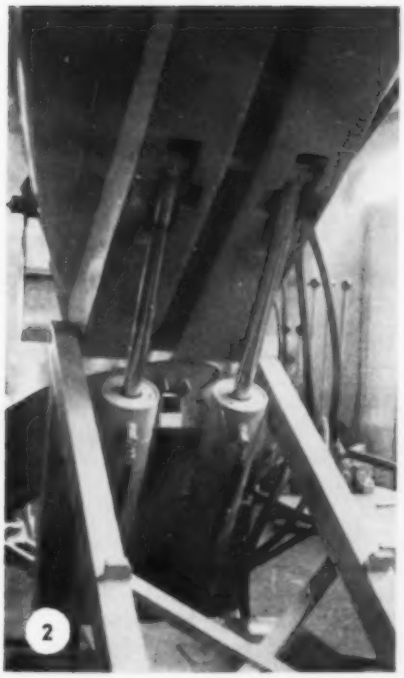
If the truck must move while pouring, such as on paving jobs, the driver opens the gate and starts the agitator. Then he returns to the cab and drives the truck. With an extension from the master valve, he controls cement discharge rate by regulating hoist position. To stop mixing in transit, he moves the 4-way valve in the bypass (#2) position, and restarts it by shifting to the neutral (#4) position.

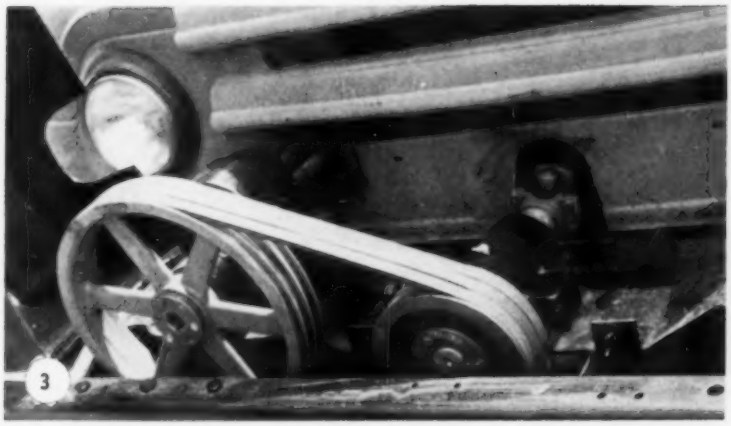
When hoisting, the 4-way valve position (#1) excludes all other operations. This is to use the maximum system pressure to initiate a full load hoist. When the master valve is returned to the neutral (#4) position, the agitator resumes turning. When the complete load has been discharged, the driver moves the 4-way valve to the bypass (#2) position, the body lowers and the power shuts off.

Except for the hoist circuit, all operations are manually sequenced by a 3-spool directional valve connected in series with the 4-way master valve, when in the #3 position. The left spool controls the agitator drive motor. The center spool controls the discharge gate, and the right spool controls chute raising and lowering.

An optional 2-position selector valve can either direct less oil to the reservoir or power a second hydraulic motor which operates a water pump for cement mixing.

A 26-gpm pump driven from the engine crankshaft supplies 1000-psi fluid to the system. In designing this unit, a large tank was used to help cool the fluid and prevent air entrainment. Sharp bends were avoided in piping. ▼▼▼



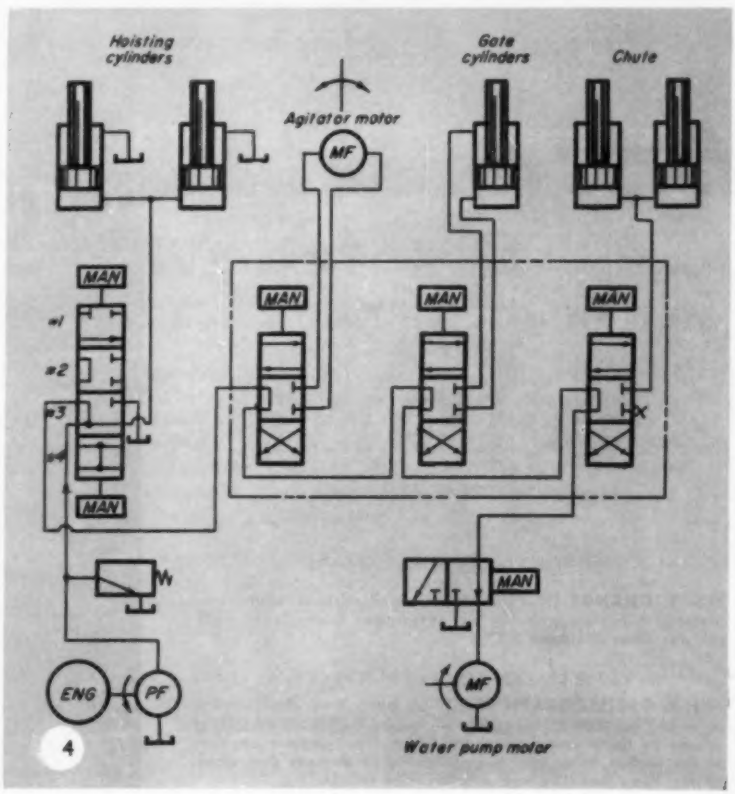


1 **CONTROLS ON THE REAR FENDER** have easy access. The 4-way master control valve has its control extended to the cab of the truck for control while driving.

2 **CLOSE COUPLING** of these two hoisting cylinders eliminates the need for a synchronizing device. The body is shown in the fully raised position.

3 **26-GPM PUMP** is belt-driven from the front end of the engine crankshaft. Protective cover is removed for inspection.

4 **4-WAY, 4-POSITION, SPRING-CENTERED VALVE** is the nerve center for the cement mixer hydraulic system. Shifting the valve to the #1 position actuates two single-acting hoisting cylinders, raising the mixer body. #2 position locks the hoisting cylinders and channels fluid to the 3-spool directional valve. Shifting to #3 position, lowers the body by connecting the cylinder port to tank by way of the 3-spool valve. The pump is unloaded when the valve is in the #4 position.



Bulk Modulus is getting to mean more and more to fluid power designs, especially for servo systems. It measures a fluid's stiffness. The biggest factor is air content. Here's one method to determine how much air is in a fluid.

How to measure air content in hydraulic fluids

• By **DONALD FIRTH**, *Principal Scientific Officer, Mechanical Engineering Research Laboratory, Glasgow, Scotland.*

ALL HYDRAULIC fluids contain some air. It may be dissolved in the fluid or held as bubbles in suspension. Suspended air causes the most trouble in a hydraulic circuit because it lowers the bulk modulus of the fluid, (makes it spongy). As air is added to the fluid, the bulk modulus decreases at a high rate, Figure 1.

As hydraulic systems become more precise, bulk modulus increases in importance. Servo systems need a stiff circuit. High air content in the fluid makes them unstable. Air in a hydraulic press circuit raises pressure build-up time, wastes horsepower, and increases overall cycle time.

Fluid with high air content also reduces pump efficiency as illustrated in Figure 2.

Continued on page 90

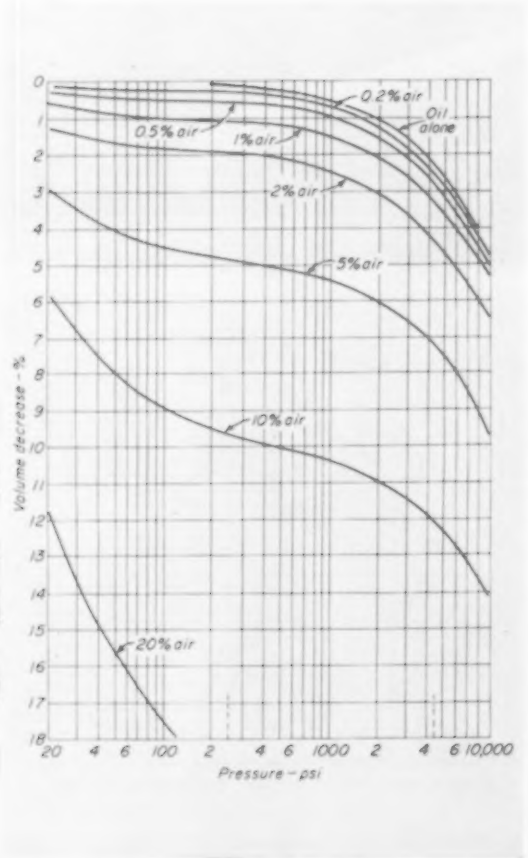


FIG. 1, CHANGE IN VOLUME of air-oil mixtures when compressed. A mixture with 5% air, compressed from 250 to 4400 psi, decreases in volume 2.3%.

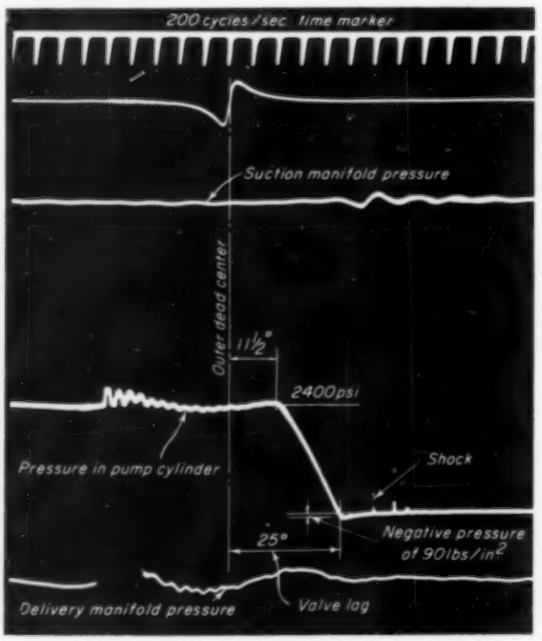
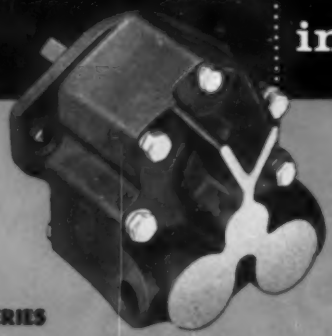


FIG. 2. OSCILLOGRAPH TRACE of pressure vs. displacement in a plunger pump. Expansion of oil in the pump chamber, caused by compressing suspended air, delays complete opening of the suction valve until the plunger is 25 degrees past dead center. Pump capacity and efficiency are reduced.

DYNAMIC DIFFERENCE

in hydraulic performance



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HOW TO MEASURE AIR CONTENT

• **Testing for air content**—Oil in the form of a spray, suddenly exposed to a vacuum, gives up its air very quickly. Air can also be easily removed from a thin film of oil. These two principles are used in an instrument to test hydraulic fluid for air content. Figure 3 shows its construction.

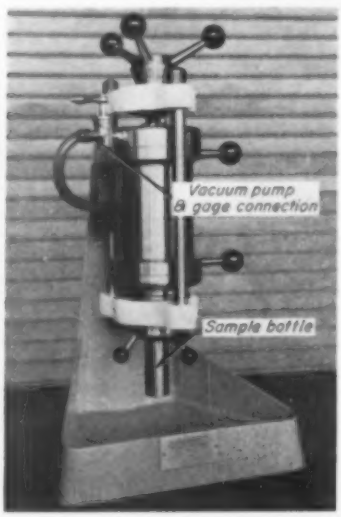

FIG. 3. TEST CHAMBER for measuring air content in hydraulic fluids. Fluid is placed in the sample bottle at the bottom. After evacuating, the chamber is tilted and fluid expands into the vacuum, giving up its air. Pressure increase in the vacuum chamber indicates the amount of air released.

FIG. 4. WEIGHT-LOADED VALVE seals the fluid sample bottle from the vacuum chamber until it tilts. Steel balls and rollers in the vacuum chamber provide a large area for oil film.

A porous cage filled with steel balls and rollers is mounted in a cylindrical chamber. A valve in the bottom is closed by its own weight when the chamber is upright. When the chamber tilts, the valve opens. A fluid sample bottle mounts on the bottom of the chamber. A vacuum pump and a gauge also connect to the chamber.

• **Test procedure**—The fluid sample bottle is filled with test oil and mounted on the bottom of the container. After evacuating the container to 0.005 mm of mercury, the vacuum pump is shut off and pressure and temperature readings taken. The container is then tipped, so that the oil sample "explodes" into the cylinder and settles on the balls and rollers. Pressure and temperature readings are taken again.

Air removed from the sample raises pressure in the container. By Boyle's Law, the amount of air added to the chamber is accurately calculated. This is the total air content of the fluid.

Changes in specific gravity of the fluid are mostly caused by air in suspension rather than chemical combination of air and oil. By taking specific gravity readings along with air content readings, two curves are plotted. One shows total air content and the other suspended air, Figure 5. ▼▼▼

Since the preparation of this article, further work has been done on this project.

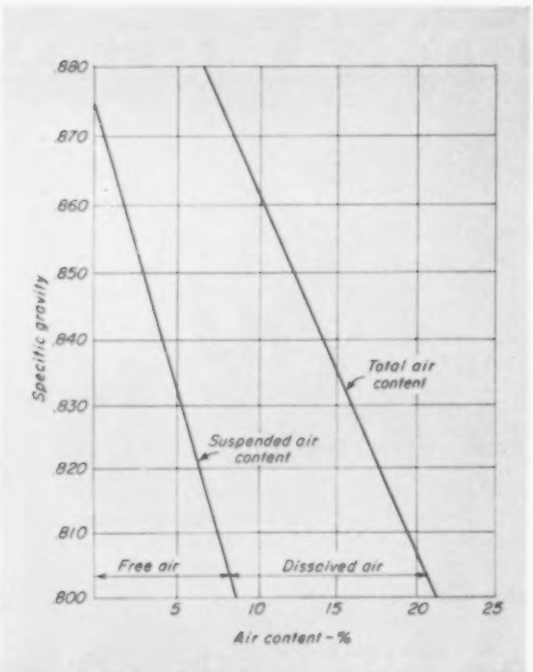

FIG. 5. SPECIFIC GRAVITY depends mostly on suspended air. These curves are for a hydraulic fluid with a viscosity of 27 Centistokes at 70 F. Taking specific gravity readings along with air content readings, permits plotting both these curves from the tests.

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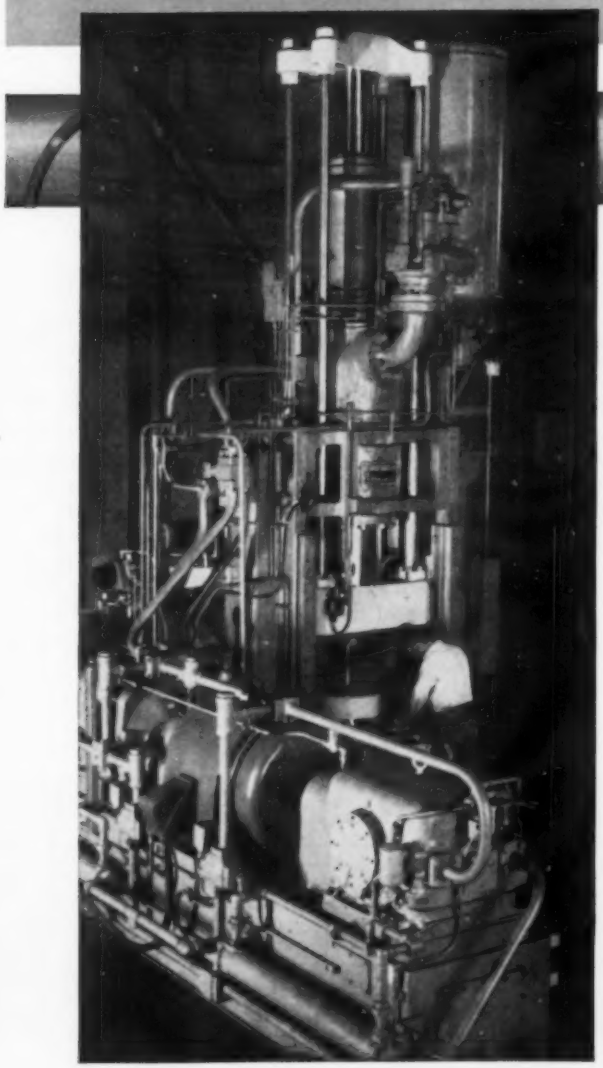

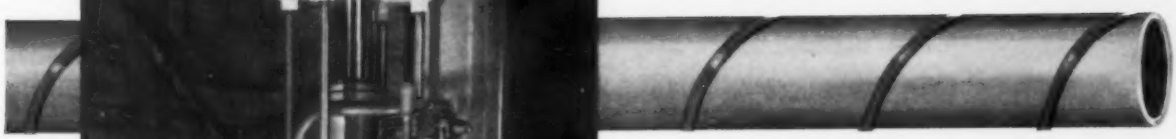

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Selecting cylinder stroke

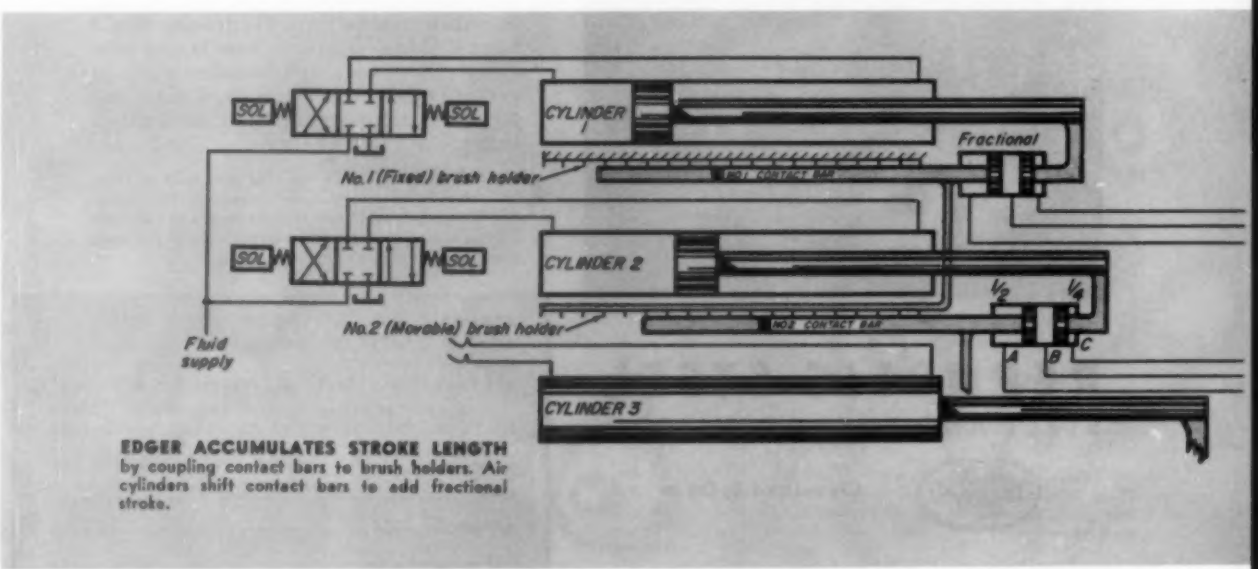
• By S. BROADBENT, *Yarrows, Ltd., Victoria, B. C., Canada*

This article was awarded $100 *in the* 1959 APPLIED HYDRAULICS & PNEUMATICS *Prize Paper Contest.*

Fluid power comes to the lumber mill. To convert logs to various sizes, an electrically selected brush contacts a sliding contact bar and adjusts cylinder stroke to vary width of cut.

TO REDUCE costs of operating a lumber mill, hydraulics, pneumatics and electrical control have teamed up to saw lumber repeatedly to exact size and still have flexibility of mixed runs. In the two sawmill operations requiring the most flexibility, we have provided pushbutton selection of board width and a smooth, uninterrupted process.

• **Five-saw edger**—this machine has five saws on one arbor and can cut a wide range of lumber sizes. To select width, a pushbutton (for each of the five saws) actuates a relay which energizes a 4-way solenoid valve channeling fluid to a hydraulic cylinder. (See edger diagram.) Electrical contact is through one of the brushes in each of the five brush holders (depending on width selected) and the contact bar against which the brush slides.



EDGER ACCUMULATES STROKE LENGTH by coupling contact bars to brush holders. Air cylinders shift contact bars to add fractional stroke.

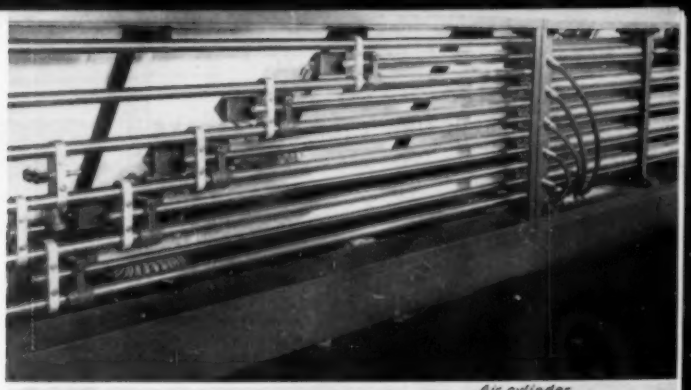
electrically

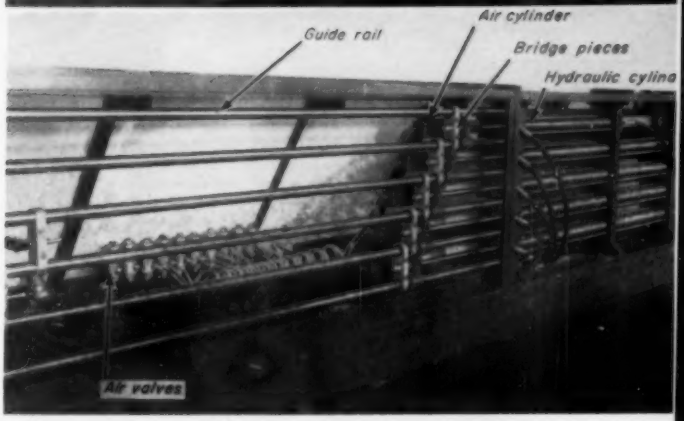
The No. 1 brush holder is stationary. As the piston of the No. 1 cylinder moves, it carries its contact bar with it. An insulated segment of the bar, reaching the energized brush breaks the electrical contact. The 4-way valve then closes, and the piston stops.

The No. 1 commutator bar is fixed to the No. 2 brush holder so that both travel together. In the No. 2 brush holder, the energized brush keeps the No. 2 four-way valve open until the dead spot in the No. 2 commutator is reached, and the No. 2 cylinder stops. The same relation holds true for the corresponding components of the No. 3, No. 4 and No. 5 cylinders.

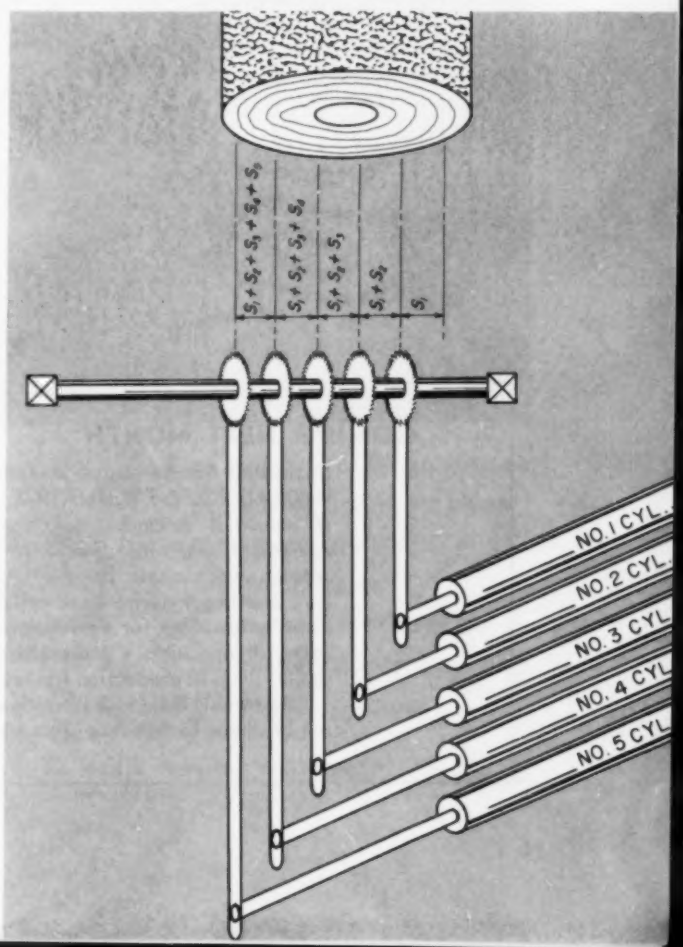
Positions are selected for each saw from its own row of pushbuttons on the panel. The piston and contact bar of one cylinder are fixed to the brush holder of the next cylinder, so that each cylinder accumulates the stroked distance of the previous cylinders, then adds its own.

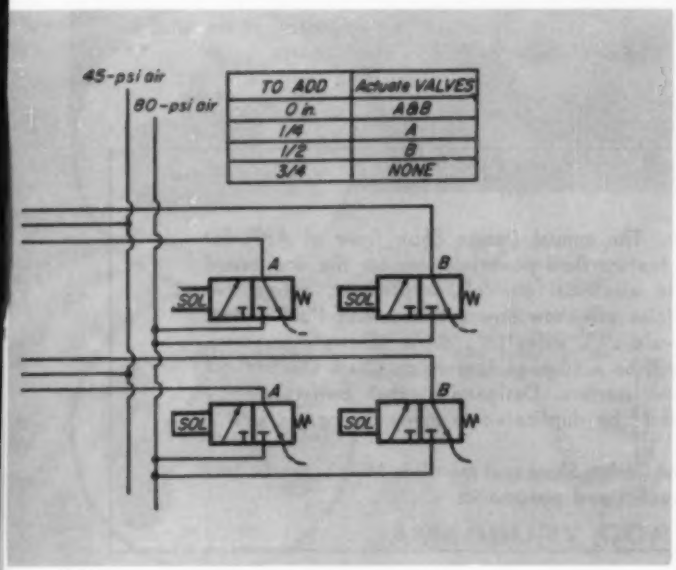
To add fractional values to saw width, pushbuttons labeled ¼", ½" and ¾" are provided for each saw



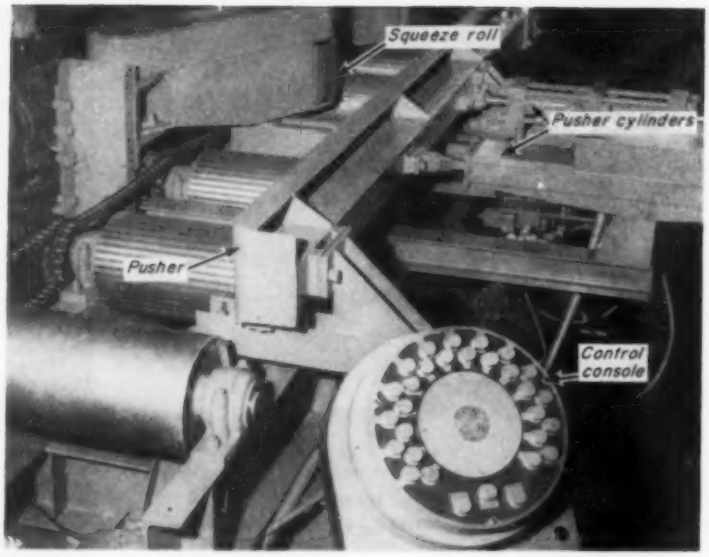


FIVE CYLINDERS stacked vertically control saw position. 4-way valves remain open to hydraulic cylinders as long as an energized brush slides on the copper part of a contact bar. Saws are attached to the bridge pieces, and slide on a common arbor to designated spacing. Air valves in background are connected by coiled plastic hose to the moveable air cylinders. Strokes (s) are cumulative as shown in figure below.



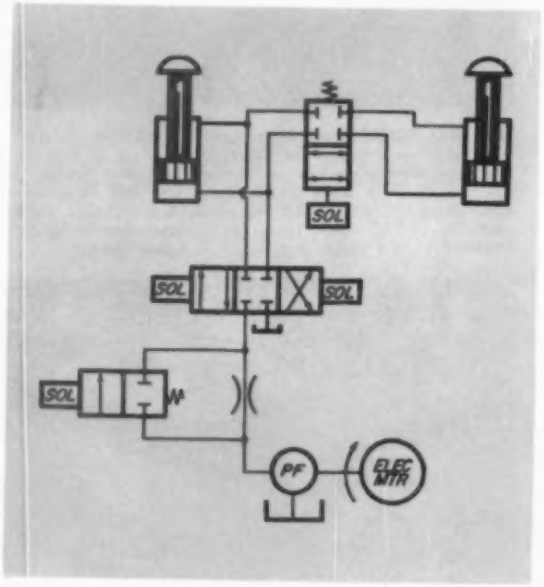


SELECTING CYLINDER STROKE



TWO-CYLINDER HYDRAULIC pusher is on the right, and the two squeeze rolls on the left of this vertical resaw machine. Log conveyor is in the center of the machine.

TWO CYLINDERS POSITION the stop on the vertical resaw machine. They slow down at the end of their stroke when a limit switch actuates the 2-way valve and closes it. This forms a meter-in circuit through the flow control valve. The cylinders are connected in parallel during their stroke; disconnected for locking when the 4-way centers.



cylinder. These determine which pistons of a small, 2-piston, air cylinder operate. One piston stroke is ¼", the other ½". Each air cylinder is fixed to a hydraulic main cylinder so that the fractional travel is added to the stroke. This gives stroke variations in increments of ¼". Air is furnished to the cylinders by solenoid-operated valves which are energized by relays according to pushbutton selection.

• **Vertical Resaw**—This machine positions lumber as it is fed into the saw. Pushbuttons on a circular console control positioning of two cylinders using a brush and contact bar system similar to the edger. These cylinders operate a stop for the lumber. The cylinders are connected in parallel and move together. To decelerate them near the end of their stroke, a normally open, 2-way valve closes, forcing flow through a flow control valve. The valve is actuated by a limit switch.

A valve connecting the cylinders, closes with the 4-way and locks fluid in the cylinders. ▼▼▼

COMING NEXT MONTH . . .

Designing for Machine Assembly. The annual *Design Show Issue* of APPLIED HYDRAULICS & PNEUMATICS will feature fluid power designs for the new breed of industrial machines that assemble electrical controls, appliances, automotive equipment, and other products. Articles will show how cylinders and fluid motors actuate mechanisms to rivet . . . weld . . . index . . . drive screws . . . clamp . . . and insert parts. Lead article will be a 10-page feature on Clark Controller's 6-station machine for assembling motor starters. Designed by their own tool engineers, it represents a project that could be duplicated in many companies with a similar jump in production figures.

Plan to visit the AH & P booth at the Design Show next month in New York. Editors will be there to talk shop about hydraulics and pneumatics.

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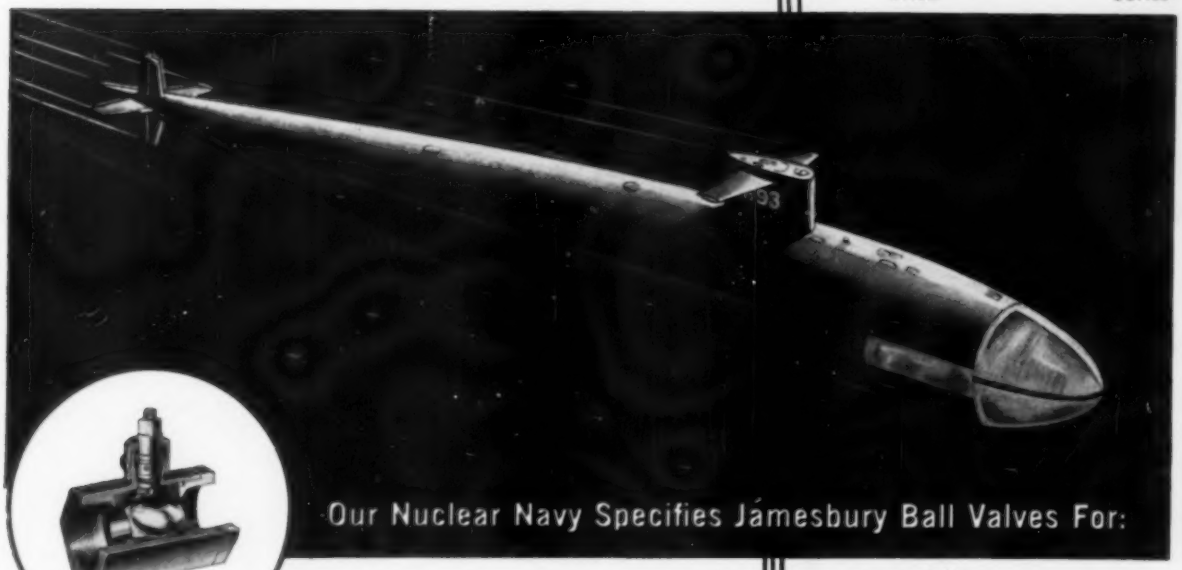

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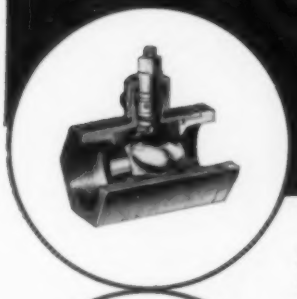

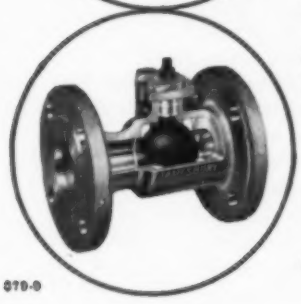

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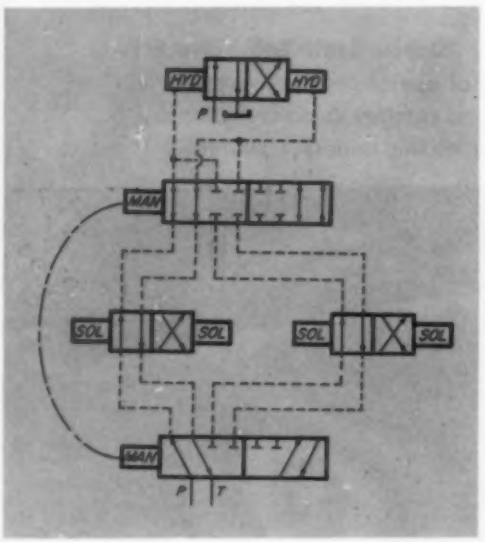
PROBLEMS & ANSWERS

• By ELMER F. HEISER, *Precision Products, Inc., Cleveland, Ohio*

Dual solenoid valves reduce downtime



DUAL SOLENOID VALVES shown schematically. Operation of the main 4-way valve is not affected by change of pilot valves. Manually operated valve is shown split for ease of circuit tracing.

Problem: Reduce downtime because of solenoid pilot valve failure.

Answer: Solenoids in pilot valves fail because of.

- Overcycling.
- Incomplete valve closure.
- High ambient temperture.
- Electrical or mechanical overload.

Though solenoid replacement is not usually a long job, in one application even this downtime had to be prevented. Two standard, solenoid-controlled, pilot valves are connected through a manual crossover valve to the

main directional valve. Only one of these pilot valves operates at a time. The other is standing by, if the operating valve fails.

The manual crossover valve is a rotary type that selects either pilot valve and isolates the other which may then be removed for repair. ▼▼▼

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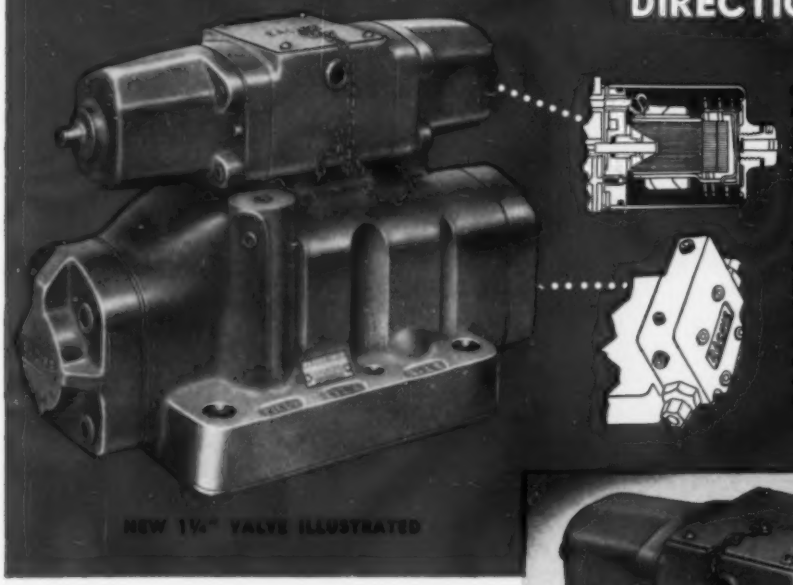

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- Direct or remote pilot pressure operation
- Throttling end caps for ¾" and 1¼" sizes
- Oil immersed solenoids available
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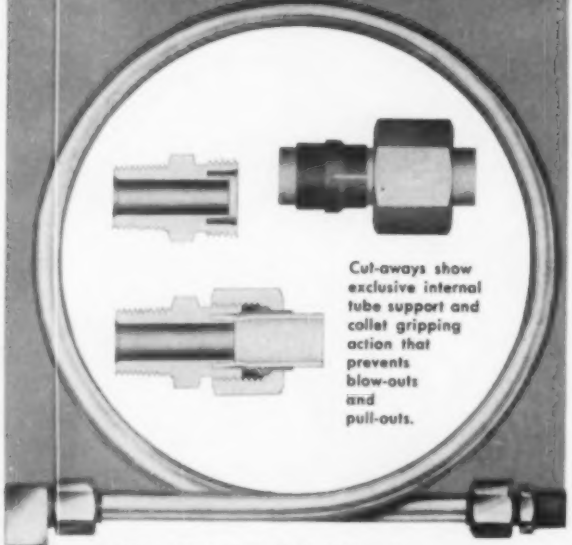

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THE KINGSBURY SLIPPER PUMP

Continued from page 75

and if the slipper tilts up in front, the resultant moves toward the rear. Thus true Kingsbury action was not yet obtained by this arrangement.

• **Slipper Modification**—We have an advantage over a Kingsbury type bearing in that we have high pressure oil available at the leading edge of the slipper. In order to be sure that this high pressure oil will always get started under the leading edge of the slipper even when there are pressure pulsations, we machine a small oil groove about one quarter way back of the leading edge and feed it by two chamfers at the ends of the slipper. This is shown in Figure 5 together with an approximate pressure distribution curve. This shows the resultant bearing pressure behind the center of the slipper. The other force shown is the resultant of the rotor and hydraulic forces on the slipper. The forces shown will tilt the slipper forward until its outer face is parallel with the cam ring. In this new position, true Kingsbury action is still not obtained and our tests show that the adhesion of the oil provides adequate lubrication to a discharge pressure of only 1200 psi.

Our tests also show that oil grooves are unnecessary if the pump is supplying a very small hydraulic system. A large system, particularly one with rubber hose, has pulsations that feed back from the system and tend to squeeze out the oil film. The oil grooves carry the pressure pulsations part way under the slippers, and still provide adequate lubrication. We tried moving the oil groove back to the middle but this took more power. We think it was because we shifted the peak of the pressure distribution curve toward the rear.

Figure 6 shows a slipper with a radius silghtly less than the cam ring radius. As the slipper tilts forward, the point of minimum oil film thickness shifts forward until the hydrodynamic bearing pressure is in line with the forces acting downward on the slipper. This can be done without losing the cohesion of the oil film, which helps hold the slippers to the cam ring since variation in oil film thickness necessary to assure hydrodynamic lubrication is less than .0001 in. With this change, true Kingsbury action was obtained up to a discharge pressure of 2400 psi which was the limit of our test equipment.

An analysis similar to Figure 4 must be made for the slippers as they pass through the sealing arc at the top of the cam ring, to assure hydrodynamic lubrication and stability through this are. If the slippers are permitted to leave the cam ring in the sealing arc, they will not be properly seated when they pass the suction port and the discharge pressure will force them noisily out and back against the rotor and cam ring. ▼▼▼

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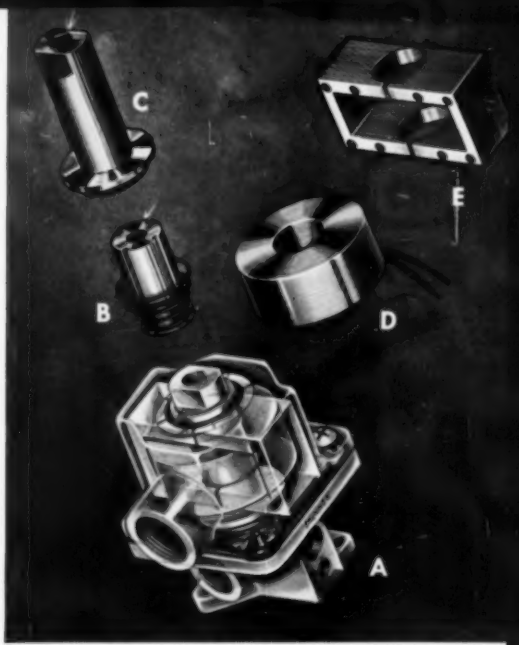
New **SKINNER** 3-way Solenoid Valves

All Skinner Solenoid Valves are...

SIMPLE— Only two moving parts in direct acting valves. Stainless steel internal parts resist corrosion. Soft synthetic inserts provide bubbletight sealing. Most types available in explosion-proof construction.

VERSATILE— Literally thousands of variations are possible—mounting, flow control and porting . . . electrical options in coils, voltages and frequencies . . . types of media, operating temperatures, etc.

UNIQUE— Skinner valve seat does not cut inserts, assures bubbletight sealing and long life. Skinner valve sleeve assembly is precision welded to provide over 5,000 PSI burst strength. Skinner standard valve designs are readily modified for custom applications. From first step in manufacturing to delivery, Skinner quality control and 100 per cent testing builds valves Skinner guarantees for long, trouble-free life.



A—Transparent view of normally closed valve with main orifice shown solid
B—Plunger and spring C—Sleeve D—Coil E—Yoke

SKINNER three-way solenoid valves solve your control system problems

Whatever your problem in controls . . . in machine tool automation, automatic clutching or braking, packaging, instrumentation, laundry equipment, air conditioning, or in any of thousands of applications involving air and hydraulic cylinders or pressurized mechanisms . . . Skinner has the answers.

Skinner design leadership and quality manufacture of solenoid valves has been proved by universally successful use. And as control problems become more complex, Skinner keeps pace with new designs, new valves, and continued top quality production.

The new A series shown above, the new L series, the V5 and V10 series complete the line of Skinner 3-way solenoid valves. Your selection is unlimited.

	V5 Series	V10 Series	A Series	L Series
Orifice sizes	1/8" to 1/4"	1/8"	1/16", 1/8", 1/4"	3/8", 1/2", 3/4"
Pressure Ratings	Up to 200 PSI	1000 PSI	Up to 250 PSI	5 to 150 PSI
Types	Normally open, normally closed, directional control, multi-purpose	Normally open, normally closed, directional control, multi-purpose	Normally open, normally closed, directional control, multi-purpose	Normally open, normally closed, directional control
Construction	Stainless steel body Stainless steel internal parts	Stainless steel body Stainless steel internal parts	Zinc die-cast body Stainless steel internal parts	Forged naval brass body Stainless steel and brass internal parts
Body Pipe Connector	1/8 and 1/4 NPT	1/8 NPT	1/4 NPTF	3/8", 1/2", 3/4" NPTF

When you specify solenoid valves, specify Skinner. Skinner solenoid valves are distributed nationally.

For complete information, contact a Skinner Representative listed in the Yellow Pages or write us at the address below.

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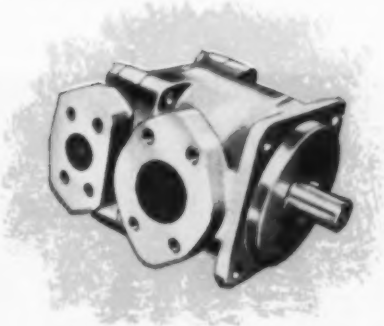

2000 PSI HYDRAULIC PUMP
. . . is incorporated into power systems of dozens of types of earthmoving equipment by leading manufacturers. Denison 2000 psi hydraulic power gets jobs done faster with dependable trouble-free operation for toughest workloads.

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Write for your copy of Bulletin P-9-3 on Denison "T1D" Series Vane Pumps. Includes complete specifications and operating data.

These completely new Case tractor shovels—the W-10 and W-12 TERRALOAD'R®—deliver outstanding work capacity. They're products of the J. I. Case Co., Racine.

And ultra-efficient Denison hydraulic power is helping these high-speed Case units do excavating, loading, grading, hauling and materials-handling jobs faster . . . at *lower operating cost.*

The W-10 (2 cu. yd.) and W-12 (2½ cu. yd.) TERRALOAD'R® dump-buckets get high efficiency, low-cost power from a single Denison 2000 psi vane pump.

Key advantage – high volumetric efficiency is *continuous* in Denison pumps . . . no drop-off in work speed – no sluggish operation to slow up the job.

Plus these advantages –"cartridge" construction of Denison pumps means speedy in-field servicing. All-weather starting features prevents pump damage. Denison pumps guarantee less weight, less cost-per-horsepower . . . more payload per dollar in your earthmoving equipment.

Your Denison Hydraulic Specialist can tell you more about significantly improving equipment performance with *hydraulic power to 5000 psi.* Call him in to discuss *making your equipment more profitable to the man who buys it!*

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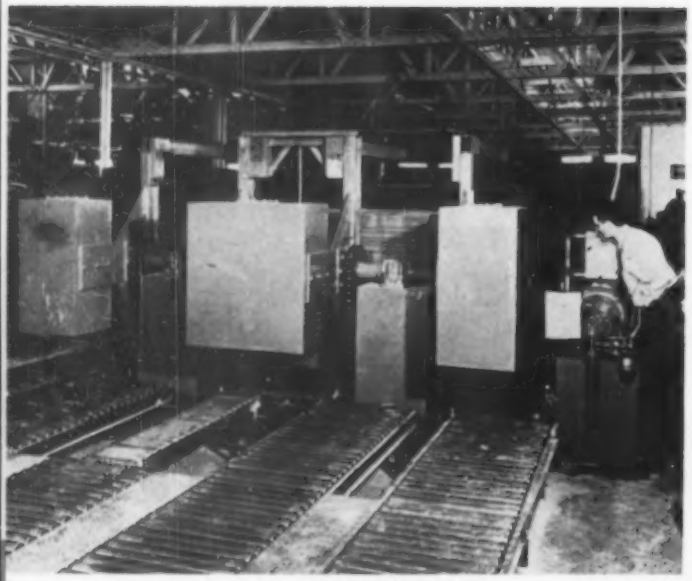
HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

Stacks of large corrugated paper sheets can be turned over as gently as a deck of cards. Rotary actuators turn over 7000 pound loads and a double rod cylinder lets them down.

Smooth turnover with rotary

• By **PAT GREENE**, *Chief Engineer, Greene Line Mfg. Corp.,*



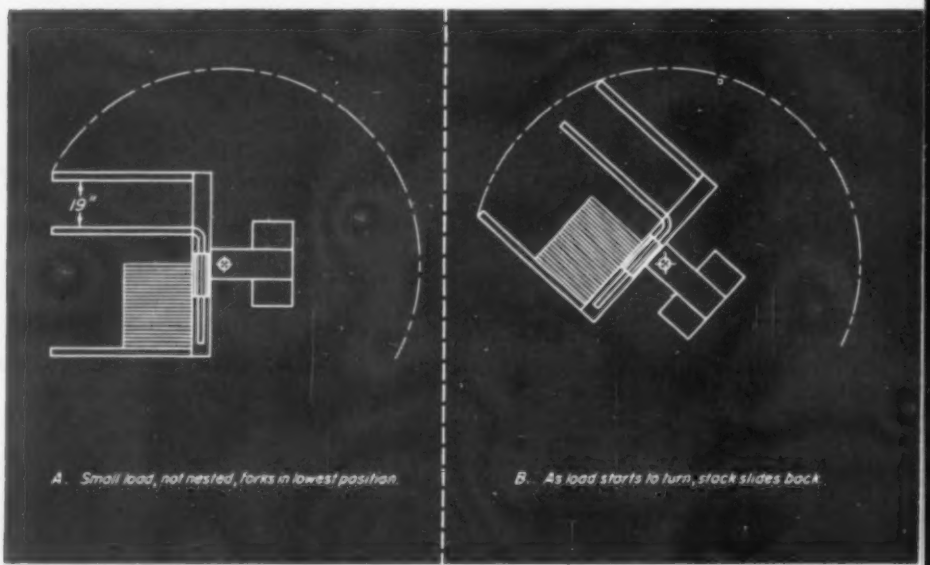
STACK TURNOVER UNITS in action. Large counterweights balance part of the load. Operator's view of the machine gives him accurate control of the cycle.

TRANSFER machines get strange assignments. One of the toughest handling problems is to turn over a pile of large stiff sheets. Greene Line engineers turned to hydraulic rotary actuators as the simplest way to do this job. In this machine, large sheets can be handled with the dexterity of a gambler dealing a hand.

Three, parallel-connected, rotary actuators each have a maximum rated torque of 115,000 inch pounds at 1000 psi. Because only 180-degree rotation was needed and 280-degree was available with the actuators, it was possible to multiply torque by using a chain and sprocket reduction drive. In this way, total torque was raised to 450,000 inch pounds (discounting friction), a gain of one third over the original equipment rating.

Power source for the system is a 12-gpm gear pump drawing from a 40 gallon reservoir. The turn over

TURNOVER CYCLE, step by step. As the load passes top dead center, the gravity actuated cylinder, acting as a dashpot, allows the adjustable forks to lower over the stack and act as a stop as the load rotates.

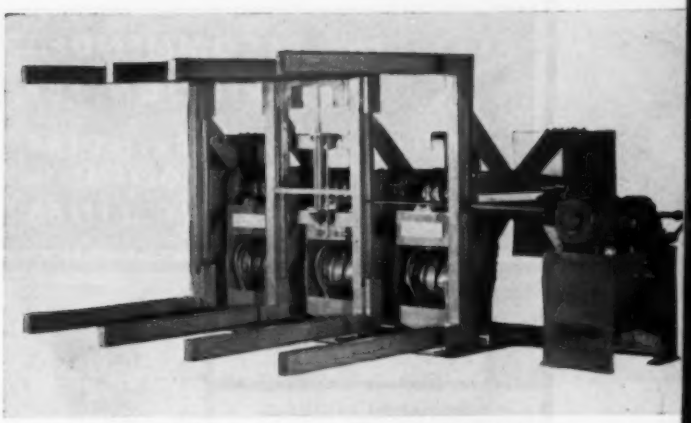


A. Small load, not nested, forks in lowest position.

B. As load starts to turn, stack slides back.

actuators

Marion, Indiana

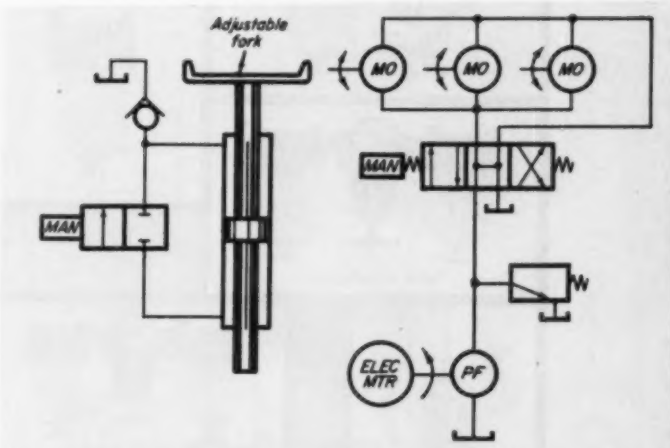


ROTARY ACTUATORS have chain reduction to the driveshaft. Gravity-actuated cylinder assures smooth transfer from one set of rigid forks to the other.

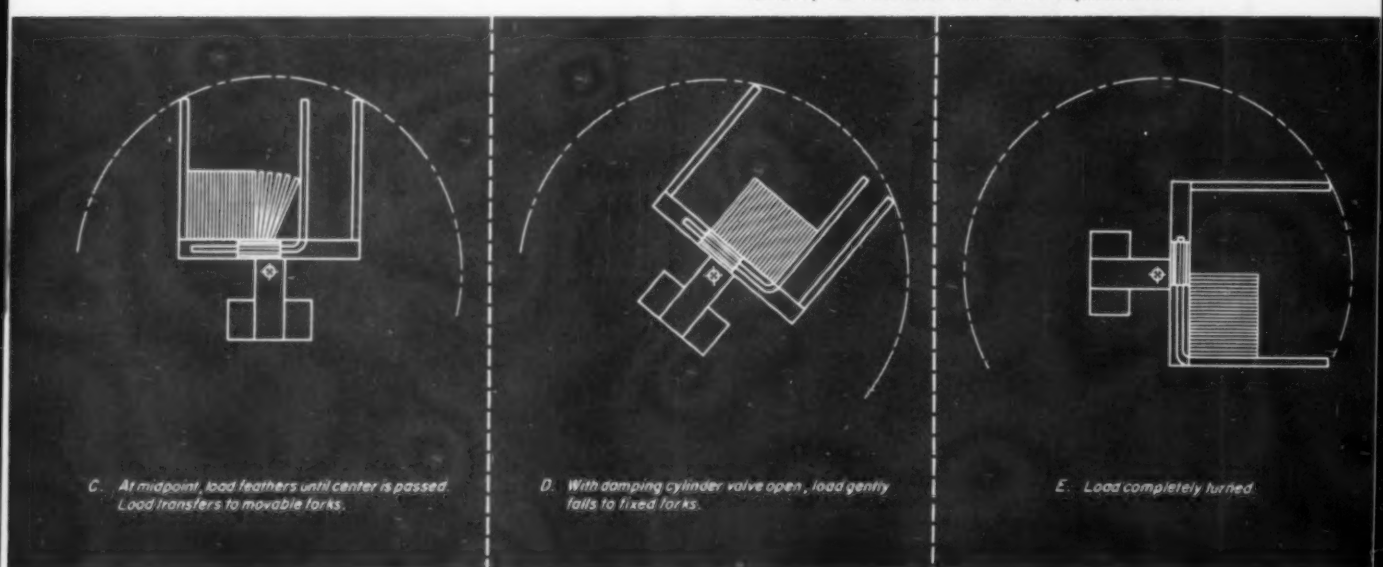
operation is actuated by a manual, open center, 4-way valve. Counterweights offset weight of the forks and a small part of the 7000-lb. stacked sheets.

To hold the sheets so they don't fall over as they rotate, two adjustable forks move with the turnover cycle. They are operated by a gravity-actuated cylinder. By operating a two-way valve, fluid transfers from one end of the double rod cylinder to the other. This lets the forks drop smoothly to form a stop as the sheets turn over. With the valve open, the tier shifts from one set of rigid forks to the other, as the machine rotates. When the moving forks drop to their final position, the operator closes the valve to prevent the forks from dropping when the turnover is reversed empty.

Throttling of the turnover valve and the adjustable fork valve gives the operator complete control over the entire cycle. ▼▼▼



PARALLEL-CONNECTED ROTARY ACTUATORS are the heart of the simple hydraulic system. One valve controls the turnover, and one valve controls the adjustable fork.



C. At midpoint, load feathers until center is passed. Load transfers to movable forks.

D. With damping cylinder valve open, load gently falls to fixed forks.

E. Load completely turned.

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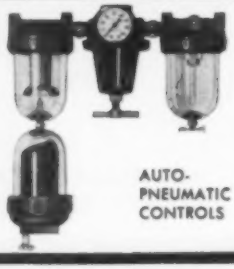

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GRINDER WHEEL HEAD ASSEMBLY shown approaching the work piece. Large control button is for releasing the clamping cylinders.

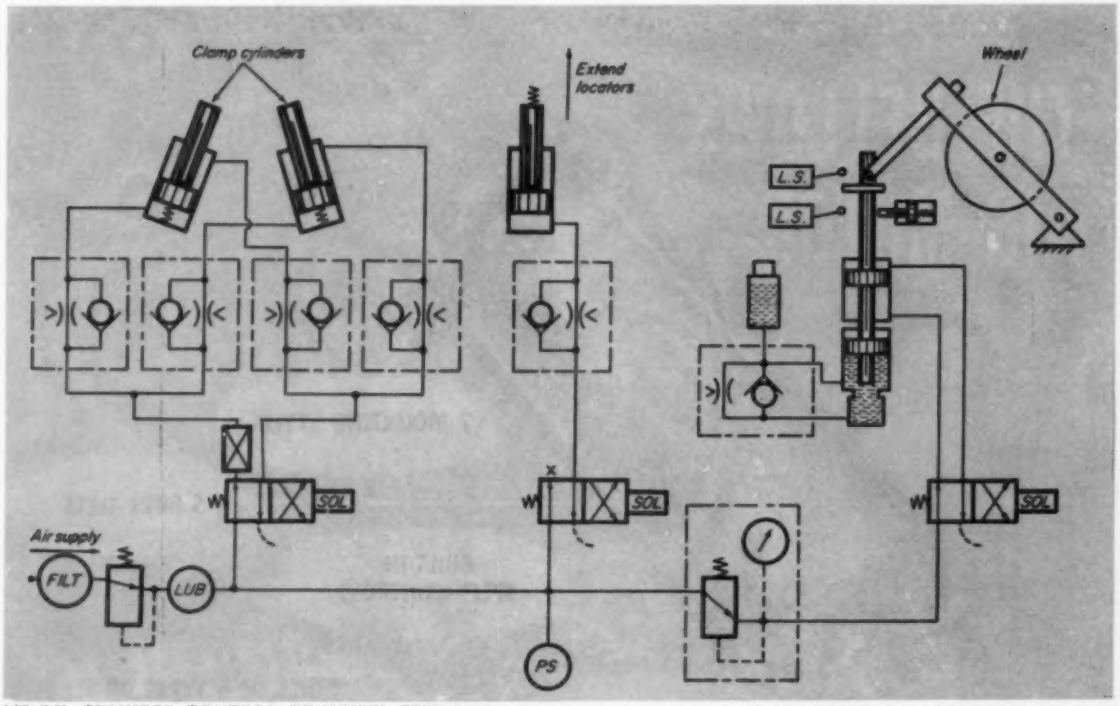
Air-oil cylinder grinder's

• By **FRANK FOSTER**, *Planet Products Corp.*,

ACCURATE feed control is the result of metering flow from an air-oil cylinder. Feed rate is governed by a flow control valve in the oil return line.

The clamping circuit has two spring-loaded air cylinders angled toward the work. They extend when a 2 position solenoid valve is energized. Another solenoid valve actuates a work-locating cylinder whose piston trips a limit switch when properly positioned. This energizes a third solenoid valve which connects air for feeding the grinding wheel.

The grinding wheel is pivot-mounted and linked to a tandem, air-oil cylinder. For fast approach to the work, the piston rod descends at a speed governed by oil escape through an orifice in the large bore part of the cylinder. As the large piston decends, it cuts off the cushion oil return path to the reservoir. The oil can return only through a variable orifice in the



AIR-OIL CYLINDER CONTROL OF WHEEL FEED is shown in circuit. Safety features include spring-loaded clamp, pressure switch for supply air, and a small air cylinder to stop wheel descent in case of air supply failure.

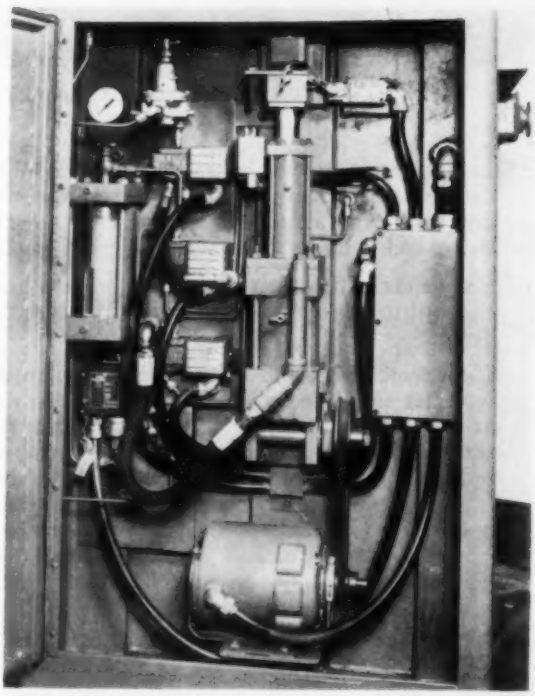
regulates feed rate

Cincinnati, Ohio

line from the small bore portion of the cylinder.

Feed rate is regulated by setting the flow control valve in the oil return line. The feed cylinder is clevis mounted on an eccentric shaft that is rotated by an electric drive. This improves cutting or roughing cuts by plunging and relieving the grinder wheel as it descends.

As the wheel nears the bottom of the slot, it trips a limit switch, de-energizing its solenoid valve and rapidly returning the wheel to its starting position. When the piston rod reaches the top of its stroke, it trips another limit switch which returns the clamp-cylinder valve to the control of the unclamp push button. In case shop air pressure drops below normal, a pressure switch shuts down the machine and a spring loaded latch pin extends to prevent the wheelhead from dropping. ▼▼▼



FEED CONTROL PANEL. Hydraulic components are neatly grouped for maintenance access. Electric motor runs the eccentric shaft to produce wheel head oscillation.

THE BELLOWS AIR MOTOR®

THE ONLY AIR CYLINDER WITH A CHOICE OF BUILT-IN VALVES

In designing for air operation, the engineer can choose the method of valving he prefers—and still have all the advantages of integral valve and cylinder construction.

Six different built-in valve arrangements give the engineer every latitude in pneumatic design.

If he prefers to use 8-12 volt electrical control with its simplified wiring, Bellows has it. If he prefers to use 115 volt control and JIC standards, Bellows has it. If he requires low or high voltage explosion-proof control, Bellows has it. Should his design require full pneumatic control, Bellows has it. Or should he wish to control his pneumatic circuits manually or through mechanical linkage or cams, Bellows has it.

Unlike conventional air cylinders which require separate remote directional and speed control valves and dual piping, the Bellows Air Motor is a complete power unit with directional valve and dual speed control valves built-in as an integral part of the unit. Only one air connection, which can be made with flexible hose, is required.

Integral valve and cylinder construction means quick response, more positive response, more precise control and more economical operation.

The Bellows Air Motor is made in five bore sizes: 1¼", 1¾", 2½", 3⅜", and 4½", and in any stroke length.

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Four-color, 20-page bulletin describes the complete line of Bellows Air Motors. Free on request. Address Dept. AH-460, The Bellows Co., Akron 9, Ohio.

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Ten Ways To Avoid Backpressure Problems

1. Use large diameter return lines
2. Avoid sharp bends in tubing and hose
3. Use minimum number of fittings
4. Keep return lines short
5. Externally drain valve seal cavities
6. Do not use filters in return lines
7. Use control valves with large return ports, (with a 2:1 piston rod, 20 gpm to the rod end discharges 40 gpm from the head end)
8. Keep fluid velocity low, (at 20 fps in ½-in. tubing, the pressure drop is 3.7 psi per ft. At 10 fps it's only 0.88 psi per ft.)
9. If valve seals are internally connected to drain make certain protective checks are included to reduce the effect of transient flows.
10. Run drain lines directly to tank, rather than into return lines

BACKPRESSURE

. . . what you can do about it

• By **JOHN J. PIPPENGER,** *Vice President, Double A Products Co. Subsidiary Brown & Sharpe Mfg. Co., Manchester, Mich.*

WHAT causes backpressure?—In a manual control valve, oil enters the inlet port and usually makes a sharp bend to get through the cylinder port. Return oil from the cylinder follows a similar path through the valve to the tank port. These direction changes cause a backpressure which varies with the flow. The line from the valve to the tank may have fittings, flows from other valves, and head pressures from overhead tanks. Each of these back pressures subtracts from cylinder pressure. Here are pointers to avoid it.

• **Tank lines**—Drain and tank lines can be light duty. Tubing walls only have to be thick enough to prevent mechanical damage. But often tank lines are the same heavy wall tubing as pressure lines to avoid accidentally using thin wall tubing on high pressure lines. Larger diameter lines should then be used to avoid restricting flow.

• **Seals**—Backpressure causes poor service life on many seals. Most mechanical seals, such as used for valve enclosure, are intended for a pressure of approximately 5 psi. Design changes can raise this to full line pressure, if friction can be tolerated. Solenoid valves are designed for low seal friction. Spring-centered valves must also have low friction, so that the centering springs can be small. On a valve with detents, or a holding device frictional drag from seals is not nearly as important.

If backpressure on seals gets too high, several things may happen. Collet grip effect caused by pressure forcing the lip of the seal against the spool preventing it from moving. With an O-ring, pressure expands the rubber and also causes a collet grip effect. Another result of excess pressure is seal damage by extrusion, deforming, or rapid wear from increased abrasion.

On many valves, seal chambers are ported directly into the tank passages. As long as back pressure on the tank port is kept low there is no damage to the seals. If there is a chance for back pressure to build up, separate drain lines should be run from the seal chambers.

Continued on page 108

The most complete line anywhere offers you the widest possible selection. Order L & L steel hydraulic fittings.

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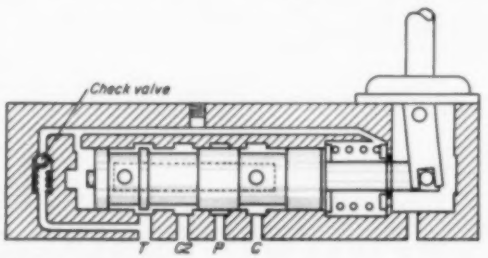
BACKPRESSURE

• **Control valves**—The tank ports on most control valves are the same size as the cylinder and pressure ports. If the tank port is connected to the seal pockets, trouble can occur when cylinders with large rod diameters are used. In a cylinder where the rod area is one half the piston area, twice as much oil must enter the head end to extend the piston as that required at the rod end to retract it. This large amount of oil required to extend the piston must return to tank when the piston retracts.

An 18 gpm pump and a ¾-inch valve to operate a cylinder, usually would be a good combination. The 18 gpm to cylinders head end would force 9 gpm from its rod end, through the valve to the reservoir. When the control valve shifted, the 18 gpm entering the rod



CHECK VALVE built into the control valve drain line prevents backpressure from forcing oil through the drain line and unbalancing the valve.

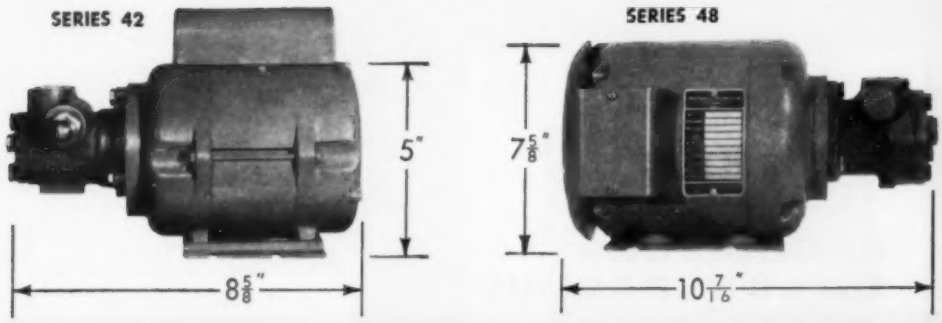
Courtesy Double A Products Co.

end would force 36 gpm out the head end. This is about twice the rated flow of a ¾-inch valve. Unless the seals are externally drained, backpressure would cause rapid seal failure.

Excessive back pressure can also create a regenerative circuit where one is not wanted. If the exhaust passage on an open-center valve is restricted and all of the ports are connected together in the neutral position, the backpressure acting on the cylinders differential area can extend it.

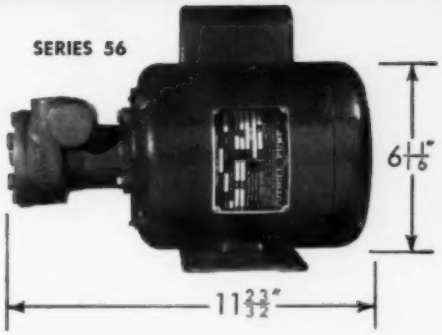
• **Spool Balance**—Many hydraulic valve spools are balanced statically, dynamically or both. Many valves are fully balanced at the pressure and cylinder ports, but the tank ports are often not balanced either statically or dynamically. In a manual valve, the stem may extend through one end of the valve. The other end may have a cap connected to the drain port. Excessive backpressure will actually shift the valve spool. Some small solenoid operated valves are also made this way. The solenoids often fail because of the power required to move the spool against the back pressure.

• **Relief Valves**—The common relief valve relies heavily on back pressures, but it too has difficulties with the wrong kind of backpressure. Normally relief valves are internally drained. If the tank lines are restricted, pressure adjustment is erratic. In the direct spring-loaded type, back pressure adds to spring force. A pilot type relief valve acts the same, except on a smaller scale because the ratios are smaller. In some types of relief valves, back pressure is amplified through the pilot and can make severe changes in the pressure setting. ▼▼▼



SAVE SPACE...WEIGHT...MONEY

with TUTHILL close-coupled pump and motor combinations



Tuthill close-coupled pumps and motor combinations are especially designed for applications where space is at a premium. Their compactness simplifies assembly operations and lowers production costs. Elimination of couplings, bases and adapters results in significant savings . . . and reduced weight means lower shipping costs.

Tuthill offers a complete selection of units with capacities up to 50 GPM for pressures to 500 PSI. A wide variety of special options is also available. Three standard units are pictured above.

Immediately available from stock

The series 42 units measure only 5"x8 5/8". Their total enclosed ballbearing motors are normally supplied with ratings from 1/12 to 1/6 HP while the pump units have capacities of 20 to 45 GPH at 200 PSI.

Series 48 units, measuring 7 5/8"x10 7/16", are normally supplied with totally enclosed, fan-cooled motors of either split phase, capacitor, or 3 phase construction . . . with ratings from 1/4 to 1/2 HP. They can be supplied with pumps with capacities from 20 GPH to 360 GPH at 200 PSI.

Series 56 units measure 6 11/16"x11 23/32", and are offered in a complete range of motors varying from 1/4 to 1 HP. These can be coupled with pumps with capacities from 20 to 360 GPH at 200 PSI.

Although motors are normally furnished for 1725 RPM they are also available for 3450 and 1140 RPM. Explosion proof construction and double shaft extensions on motors are also furnished in series 48 & 56. Built-in relief valves are optional on all five pump sizes.

Special construction for OEM applications

The units shown plus others in Tuthill's line are immediately available without any quantity restrictions whatsoever.

For those original equipment applications involving substantial quantities, Tuthill's engineers can design and build a POWERMITE . . . an exclusive Tuthill design in which pump and motor are combined in one unit which takes up no more space and weighs no more than a standard electric motor. As an example of the compactness possible a Tuthill POWERMITE now being supplied for a hydraulic application measures only 4 3/4"x8 1/6", yet has a capacity of 16 GPH at 350 PSI.

Tuthill's field engineers will be happy to provide details on the complete Tuthill close-coupled line and its application to your particular problem. If you are trying to fit a pump and a motor into a tight space you should talk to them soon. Call today.

Tuthill manufactures a complete line of positive displacement rotary pumps in capacities from 1/3 to 200 GPM; for pressure to 300 PSI; speeds to 3600 RPM.

PUMPS FOR YOUR PURPOSE

TUTHILL PUMP COMPANY

981 East 95th Street, Chicago 19, Illinois

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for Hydraulic-Pneumatic Service

For top efficiency and little downtime, apply Garlock Teflon Packings wherever fluid power is used.

CHEVRON†Packings of solid Teflon—or rubber, coated with Teflon—are as close to "frictionless" as you'll find. First of all, Teflon has the lowest coefficient of friction of any solid material in use today. Moreover, the CHEVRON itself is designed to permit free operation with minimum friction at all pressures. Here's how: with increasing pressures, CHEVRON packing rings tighten to prevent leakage. As pressures decline, the rings instantly ease off, permitting free operation of the rod, ram, or piston without leakage. This exclusive hinge-like construction lengthens packing life and, with proper initial adjustment of the gland, eliminates all further adjustments necessary to compensate for pressure variations. Catalog AD-115.

Teflon "V" Rings for higher pressures. Flexible enough to respond quickly to low gland and fluid pressures due to tapered "V" design.

"O" Ring Packings made of solid Teflon or rubber, coated with Teflon provide exceptional anti-friction qualities on equipment where a round-bodied seal is required. And, a new slotted Teflon ring is available to simplify installation in standard AN grooves. Catalog AD-148.

Teflon-Coated Cups—the first advance in cup design in thirty years. Garlock has perfected a technique whereby cups are coated with a thin layer of Teflon which then becomes an integral part of the cup. Teflon-coated cups reduce breakaway and running friction, and completely eliminate "squealing." Catalog AD-145.

GARLOCK

Other fine advantages of Teflon packings: Solid Teflon is chemically inert, non-flammable, resilient, long wearing. It can be applied against new synthetic hydraulic fluids at temperatures ranging from −100°F to +500°F.

Discuss Garlock Teflon Packings with your local Garlock representative. Call him at the nearest of Garlock's 26 sales offices and warehouses throughout the U. S. and Canada, or write The Garlock Packing Company, Palmyra, N. Y.

Canadian Div.: Garlock Packing Company of Canada, Ltd.

Order from the Garlock 2,000 . . . two thousand different styles of Packings, Gaskets, Seals, Molded and Extruded Rubber, Plastic Products.

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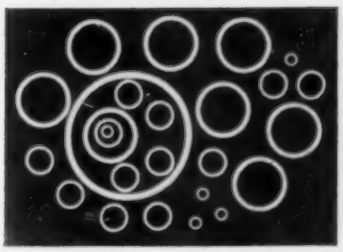
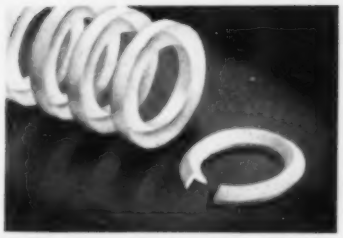
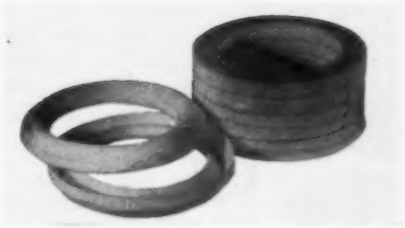


"O" Rings are applied where round-body static or dynamic seals are required



"V" Rings are used as piston or stuffing box seals against reciprocating and oscillating motions



CHEVRON Packings assure positive seal on rams, plungers, reciprocating rods

Teflon-coated cups reduce breakaway friction on inside-packed reciprocating pistons

GLUEING PRESS in background uses reciprocating booster to raise 125 psi air pressure to 2000 psi hydraulic pressure. Wood strips are being prepared for edge glueing on the infeed table prior to being placed in the press.

An air-oil booster works well where cylinders extend at low pressure and then have a short work stroke at high pressure. Both initial cost and operating expense are low.

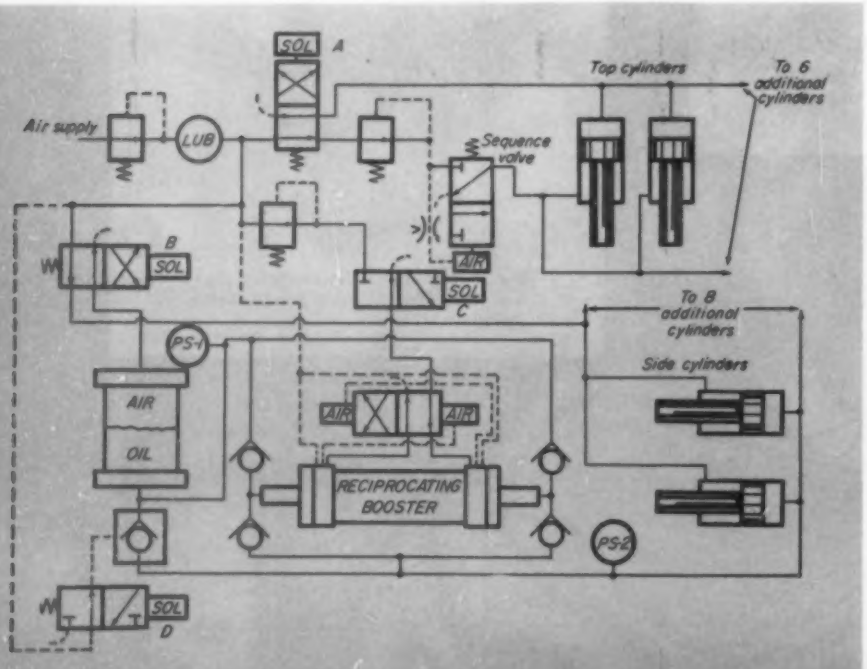
High pressure at low cost with air-oil booster

• By **PAUL H. QUILLEN,** *Union Tool Corp., Warsaw, Indiana.*

TEN, 6-inch diameter hydraulic cylinders compress wood panels together in this glueing press. Since all of the cylinders extend together, a high volume of oil must be delivered in a short time. A very large pump and motor would be required to furnish this quantity of oil. Also considerable power would be lost in heat when holding pressure on the wood panels while the glue cures electronically. Union Tool uses an air-oil booster circuit which gives them both speed and power saving.

Air pressure forces oil from an air-oil tank to extend the cylinders fast. When the cylinders meet the work and pressure builds up, a pressure switch actuates a 3-way valve directing air to the booster. The booster intensifies air line pressure 16:1. With air at 125 psi, oil is delivered to the cylinders at 2000 psi. The booster holds the pressure without consuming any power. It operates only enough to compensate for any leakage.

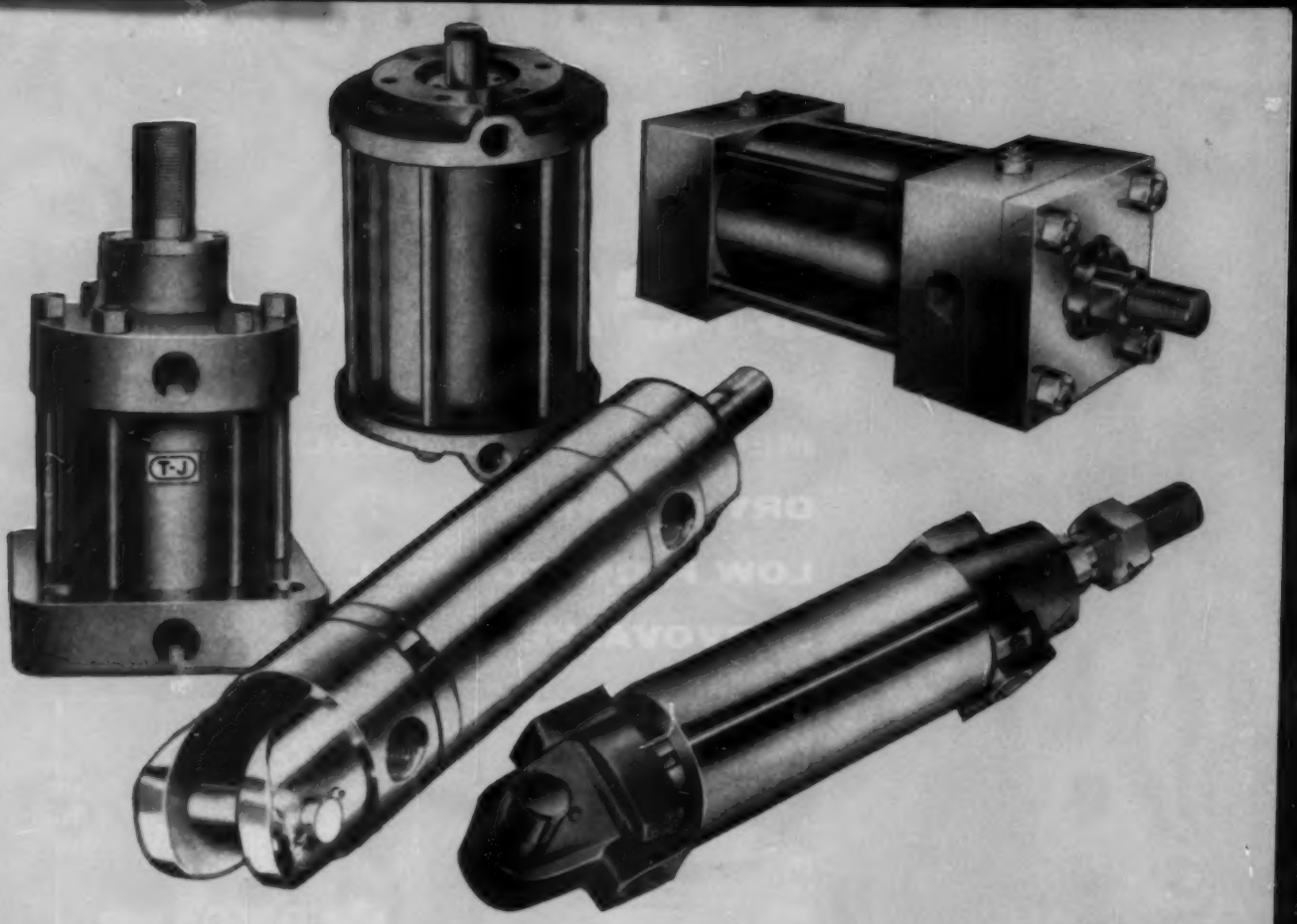
The machine also has eight air cylinders that hold the work down while the side cylinders are under high pressure from the booster. Air to retract these top cylinders passes through a reducing valve between the control valve and the cylinders. A 3-way sequence valve in this line allows the rod end of the cylinders to exhaust as the cylinders extend. When the line is pressurized to retract the cylinders, the valve shifts to allow air into the rod end of the cylinders. ▼▼▼



● **How it Works**—After the press is loaded, the operator presses a push-button which energizes solenoids *A* & *B*. Air pressure extends the top cylinders and forces oil from the air-oil tank to extend the side cylinders. As oil pressure builds up in the side cylinders, pressure switch PS-1 actuates solenoids *C* & *D*. This directs air to the reciprocating booster and closes the pilot check valve at the air-oil tank. When the required pressure on the side cylinders is reached, pressure switch PS-2 starts a dielectric generator which applies induction heat to the work. An interval timer times out to shut off the generator and de-energize all solenoids, except solenoid *D*.

Air pressure retracts the side cylinders and returns oil from their head ends to the air-oil tank. After a slight delay, set by a flow control valve, the sequence valve shifts and the top cylinders retract.

Circle **121** →



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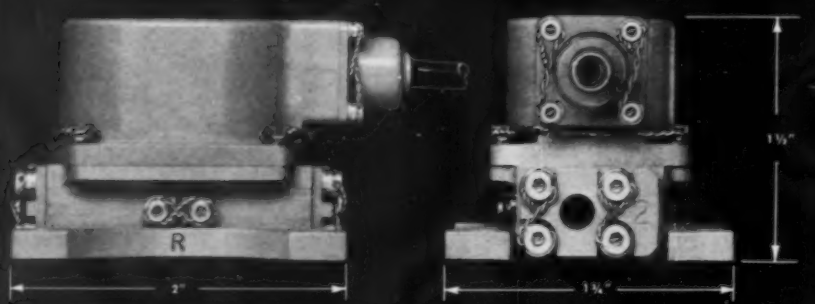

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APPLIED Hydraulics & Pneumatics

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AIRCRAFT SECTION

MISSILES • SPACE VEHICLES • GROUND SUPPORT

F-R FLUIDS AND AIRCRAFT PUMPS 116

By Robert W. Jeffery

Pump endurance tests for Convair's 880 jet transport. Test procedures and results with two fire resistant fluids—one silicone base, the other phosphate ester.

AVIATION NEWS FROM THE FLUID POWER FIELD 120

AIRCRAFT COMPONENT DATA 122

New design approach to hot fluid test equipment demonstrates some hydraulic and pneumatic systems for aircraft and missiles. For more information fill in and mail post card bound in this issue.

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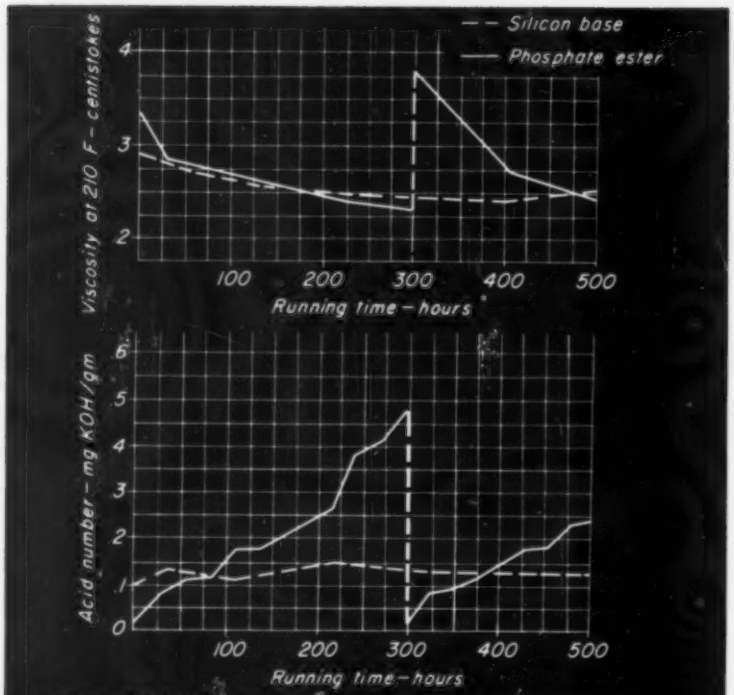
Circle 87

Large, new jet transports use fire-resistant fluids in their systems. Here's how a variable displacement pump is endurance tested with two F-R fluids.



FLUID ACID NUMBER was limited to .5 mg KOH/gm. Acid number and viscosity of the fluid are plotted versus endurance time. Phosphate ester fluid was replaced three times during the 1000-hour run to keep within specified acid number.

F-R fluids and aircraft pumps

● By **ROBERT W. JEFFEREY**

Project Engineer, Hydraulics Group, Hamilton Standard Division, United Aircraft Corp., Windsor Locks, Connecticut.

AFTER a year of development, we have successfully completed a 1000 hour endurance test and environmental tests to qualify a pump for the Convair 880 jet airliner. The radial piston pump gets its variable delivery by changing eccentricity of its piston support ring. Flow is rated at 17.8 gpm at 3750 rpm and 2500 psi, and zero output at 3000 psi. Maximum full flow pressure is 50 psi less than the cutout pressure setting.

Qualification tests were based on MIL-P-19692, except that the endurance runs were divided into two ½-hour simulated flights, each having conditions of a commercial jet flight. During the 1000 hour test, the pump flow was cycled 22,000 times at speeds of 2075 to 3937 rpm with inlet temperatures of 160 to 190 F. For about 7% of the time, the pump drew a vacuum of 16 inches of mercury to simulate failure of the inlet pressurization equipment at high altitude.

● **Phosphate ester test**—In designing the pump, we used bronze instead of phenolic bearing separators and increased bearing size and capacity. We changed sealing materials for compatibility with phosphate ester fluid. After testing for 500 hours, the central rotor bushing deteriorated. It acts as both a journal bearing and a high pressure seal. This caused excessive leakage and high heat. We tried to float the load by pressure balancing without sufficient improvement. Silver sulfide formed on the bushing surface, and a new bushing material was needed. This sulfide could have come from the synthetic O-rings or from the fluid itself.

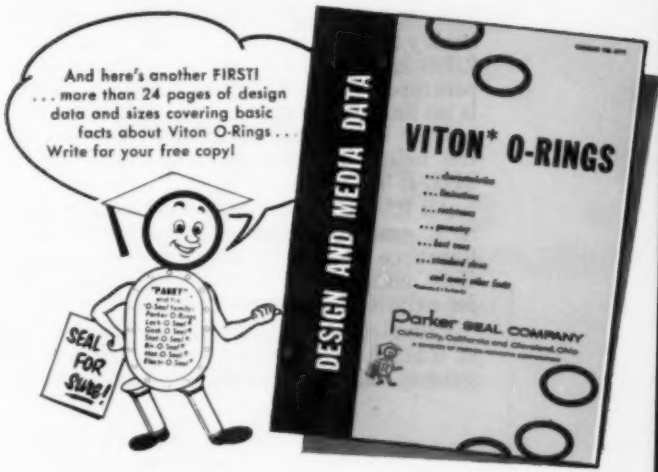
Radial, load-carrying bearings failed in the pump. Because of bearing material appearance after the test, we suspected that the fluid or a decomposition product formed under extreme pressure caused failure. Bearings made of tool steel were tried successfully.

Fluid properties affecting sliding friction and sliding wear

Circle 96 →

NOW— VITON O-RINGS IN ALL A.N. OR A.R.P. STANDARD SIZES

One of the first to embark upon a research and development program for Viton O-rings, Parker Seal Company now makes another significant advance in this versatile high temperature material by offering Viton O-rings in all A.N. or A.R.P. standard sizes. This means faster delivery and greater economy for all these popular O-ring sizes. It's another plus result of **responsible leadership** *in O-ring engineering by Parker.*


And here's another FIRST! . . . more than 24 pages of design data and sizes covering basic facts about Viton O-Rings . . . Write for your free copy!
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BOMARC pressure system components include RMC-Lindsay Gauges

The Boeing Bomarc, a true "push-button weapon," automatically seeks out and destroys its target. In such a weapon there can be no compromise in the performance requirements for its mechanical and electronic components.

Among these components, RMC-Lindsay "gearless" pressure gauges are employed on two Bomarc assemblies—the ram jet full pressure system and the nose air pressurization system.

RMC-Lindsay gauges withstand shock tests of 100 G's. They are checked for accuracy in vibration tests ranging from 10 to 2,000 cps at 35 G's and at ambient temperatures from −65° F. to +430° F. There is no linkage, no gear train—the indicating pointer is attached directly to the end of the helical bourdon coil. Qualified under MIL-E-5272.

Model #6906
(Half Size)

All RMC-Lindsay gauges are built to the most exacting standards for accurate performance under the most rigorous conditions encountered in modern industry, in jet aviation, in astronautics.

Complete engineering and production facilities are available at RMC for subcontract work in pressure system components—gauges, valves, switches, etc. Write, wire or phone:

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RMC
LINDSAY PRESSURE GAUGES

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showed up well in this test. Not only were the piston heads and sidewalls in excellent condition compared to similar samples using MIL-O-5606, but tests showed that film strength of the fluid was very high in both the low and high acid-number samples.

The test required a minimum of 40 starts with pump and fluid at −65 F, and a 5-minute warm-up from −65 F to oil inlet temperature of 160 F and in an ambient of 70 F. One test was to determine that no dangerous overheating (425 F max.) would result if an inlet line failed. The inlet of one pump was open to atmosphere and the pump run for 15 hours. The housing reached a peak temperature of 346 F in 12 minutes. It then dropped to 160 F at the end of the run.

To evaluate pump performance under inlet starvation conditions (if the firewall shutoff valve were closed because of a fire in the engine pod, a hydraulic leak or a damaged pressure control) a valve was connected in parallel with the firewall shutoff valve to dump pump outlet to drain when the inlet closed. In tests on actual components, pumps operated 15 hours without damage.

• **Silicon fluid test**—The pump used for this test differed only in bearing loading, rotor bushing, and pressure control. Testing was the same. Although the 500-hour run was not long enough for a new fluid, success of this run is encouraging.

Some insolubles were caught by the filter, but the fluid manufacturer feels this is now corrected by factory filtration.

Some comparative features of these two fluids are:

1. Buna N elastomers are good for silicon-base fluids, but Butyl must be used with phosphate esters.
2. Esters are toxic to personnel, but silicons are no problem.
3. Silicons do not attack paint or plastic parts. ▼▼▼

The complete guide to FLUID POWER APPLICATIONS

This 1028 page volume includes:

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Robbins VALVES Are the Most Economical You Can Buy

1. The only valves that can be completely serviced in less than 1 minute from the front of mounting panel without removing the valve from the line!

To service a Robbins Metering & Shut-Off Valve it is only necessary to remove the handle, loosen locknut and remove barrel assembly . . . all accomplished from the front of the panel . . . no need to disturb the line connections!

2. Single barrel assembly!

For both civilian and military installations the single barrel assembly design and construction features (barrel, spindle, spindle seals, barrel seals and seat in one unit, cleaned, lubricated, sealed for oxygen service) mean practically instantaneous renewal of service without disconnecting any plumbing.

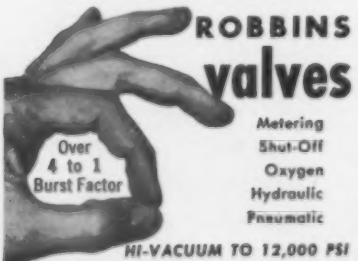
3. As many as 5000 cycles before requiring servicing!

Many Robbins Metering Valves . . . in constant use on an 8-hour a day basis for three years . . . have never required servicing, lubrication, or any parts replaced!

...And the Most Reliable!

Precision made and tested. Design capabilities, manufacturing procedures, and quality control operations at Robbins Aviation are all directed toward one objective . . . to produce a valve of the highest quality that will provide the user with the greatest reliability and the greatest economy over many years of service.

All Valves LOX Cleaned and Packaged . . . Ready for Instant Use



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AVIATION NEWS

from the fluid power field

Parker Aircraft Names New Chief Engineer

William R. Rector has become chief engineer of **Hydraulics Div., Parker Aircraft Co., Div. Parker-Hannifin Corp.,** Los Angeles, Calif. He was formerly engineering department manager of Marquardt Corp., and assistant project engineer for Convair.

Rector

Chao

New Vickers Research Chief

Dr. W. Wai Chao has been appointed chief of research at **Vickers, Inc., Div. Sperry Rand Corp.,** Detroit, Mich. Prior to joining Vickers, he directed engineering for the second stage, liquid rocket engine for the **Discoverer,** and attitude control rocket systems for **Project Mercury** and the **X-15.**

Air Force & Navy jobs go to Cornelius Co.

Three defense contracts totaling over a million dollars have been awarded to The Cornelius Co., Aero Division, Minneapolis, Minn. The AF contract of over $900,000 is for a high pressure, air compressor, modification program for B-52 aircraft. It was the result of more than 12 months of research and development. One Navy contract for nearly $300,000 involves special Cornelius compressors in the Navy's fleet of anti-submarine aircraft. Another Navy contract, nearly $200,000, is for new, high pressure air compressors to be used on Grumman F-11F, Tiger jet aircraft.

Made Hydro-Aire Representative

Harold Maine has been appointed by **Hydro-Aire Co., Div. Crane Co.,** Burbank, Calif., as sales engineer for the Pacific Northwest. He has been in sales engineering for over eight years. Headquarters will be in Seattle.

Management Changes at Adel

Walter J. Yuss has been named general manager of **Adel Precision Products Div., General Metals Corp.,** Burbank, Calif. For the past eight years, Yuss has

Yuss

Drummy

Topham

been in manufacturing, production, and sales subcontracting. He was formerly with Pullman Standard Car Mfg. Co. **W. J. Drummy** is now manager of engineering and sales. He was with Turbocraft's Tork-Sel Div. **Lee W. Topham,** new chief engineer, directs design and development.

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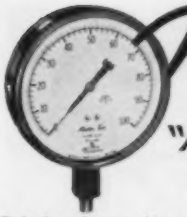
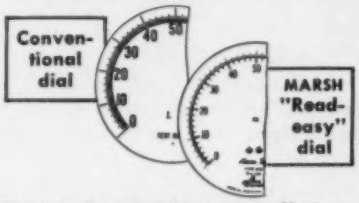


New MARSH "Master-Test" SERIES

Twin-tip pointer enables observer to read "dead-on" by lining up twin tips like gun sight.

Unprecedented accuracy and dependability in test gauges developed to meet today's exacting requirements. Each gauge individually *dead-weight tested!* Guaranteed accurate within ¼ of 1% plus or minus of maximum dial reading over entire range.

Mirror dial also insures accurate "dead-on" reading.



New "Read-easy" dial (patent pending), as illustrated above, assures reading accuracy in keeping with indicating accuracy. Also note three advanced means of reading available in all "Master-test" gauges: twin-tip pointer, mirror dial, and "non-parallax" dial as shown opposite.

Sizes 4½", 6", 8". All standard pressure ranges 0-15 psi to 0-30,000 psi, vacuum and compound.

"Non-parallax" dial has Plexiglas insert that assures accurate reading even when read at angle.

Ask for new 20 page bulletin covering all details

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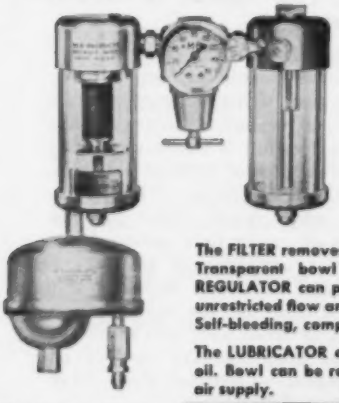

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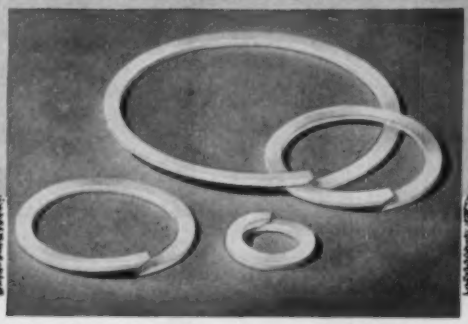

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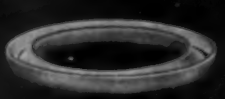
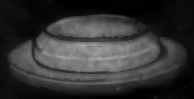


Style 614 V Rings

Style 410 U Cups and Blocked Vees



Style 210 Flange Seals

Halogen cylinder packing is known for operating successfully and efficiently over the widest temperature and pressure ranges . . . because they are "MEMORIZED".

This is an EXCLUSIVE process which makes the packing lip "remember" the size of the rod or cylinder . . . and keeps it in sealing position, regardless of temperature variations.

Send your prints for assembly details and find out about FIELD PROVEN AND ENGINEERED "TEFLON by HALOGEN."

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are our main products

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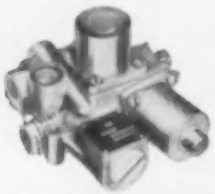
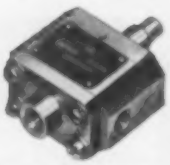


- SOLENOID VALVES



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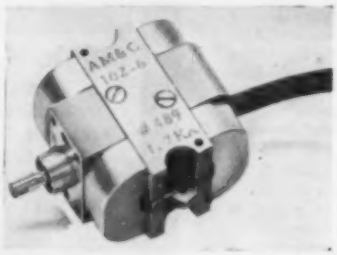
AIRCRAFT COMPONENT DATA

Miniature D-C Torque Motor . . . gives rotary output

Output is rotation of shaft. No backlash, end-play, or radial play.



O-ring around output shaft isolates motor from controlled medium. Operates to 650 F. Hysteresis is 1%. *American Measurement & Control, Inc., Waltham, Mass.*

Circle **500** on Time-Saver Card

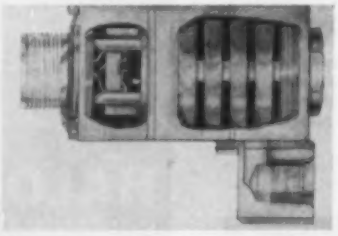
O-rings . . . with high tensile strength

Made from silicone rubber compounded with Teflon fibers. Tear strength 350 psi, tensile strength 1000 psi. Can be used with fire resistant and petroleum base fluids at temperatures to 350 F.—*Haveg Industries Inc., Taunton Division, Taunton, Mass.*

Circle **501** on Time-Saver Card

Pressure Switch . . . for flammable fluids

Switch has two separate compartments in one housing. Flammable media can't reach the switch element or electrical connector in the event of a rupture. Welded aluminum construction. Pressure range 2 to 125 psi. Proof pressure over 200 psi. Temperature range —300 F to 500 F. Will stand vibrations to 2000 cps at 25 g.—*Meletron Corp., Los Angeles, Calif.*



Circle **502** on Time-Saver Card

Sampling Valve . . . for particle counts

Model 3024 valve extracts fluid at midstream. Doesn't disrupt flow or pressure. Replaces needle valves and tees. Meets laboratory and field systems requirements.—*Industrial Measurements Sales, Inc., Pomona, Calif.*

Circle **503** on Time-Saver Card

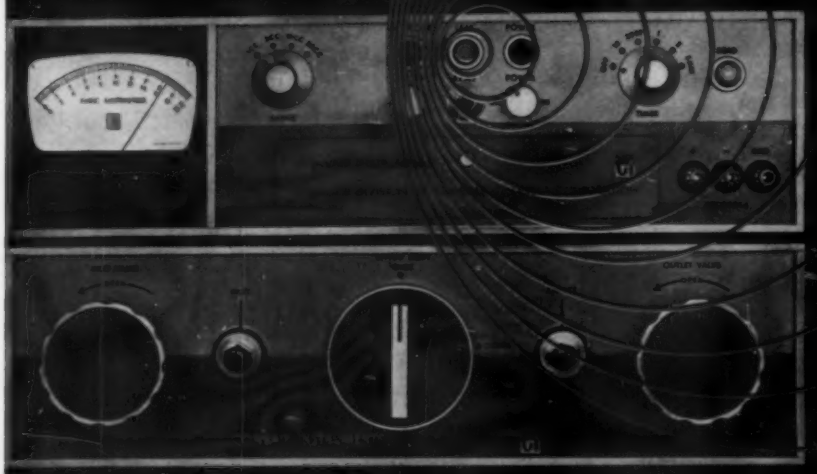
Floating Mechanical Seal . . . for speeds to 150,000 rpm

Centrifugal forces of rotor create pressure at outer periphery of labyrinth seal. This pressure exceeds external pressure against seal. Seals when rotation is eccentric. Mating faces lapped to flatness less than molecular size of gas or liquid. Rotor moves axially, floats by pressures of gas or light spring. Operates at temperatures to 1400 F. Thermal expansion improves sealing at shaft. No mechanical attachment between rotor and stator. Internal pressures take care of adjustments.—*Cartriseal Corp., Lincolnwood, Ill.*

Circle **504** on Time-Saver Card

Continued on page 124

some leaks don't make drops



the all-new CI LEAKMETER doesn't depend upon catching drops in the measurement of hydraulic or fuel leakage!

The CI LEAKMETER, *when installed in a line between a pressure source and the system or component under test, automatically detects and signals the existence of a leak. It automatically measures and indicates the amount of the leakage. A red light signals the presence of a leak –the amount of leakage is indicated on an electrical meter. The* LEAKMETER *incorporates a timer which can be set for test durations of 15 seconds to 5 minutes, providing a range for the instrument of 0.008cc to 80cc per minute. To measure other rates of leakage, or to test for sustained zero leakage, the timer may be overridden and the test conducted for any desired period.*

The LEAKMETER consists of an Hydraulic Assembly and an Electrical Assembly. These may be installed together, or at separate locations in the test area. Both are designed for rack mounting. Hydraulic connections are made by quick-disconnect fittings.

The LEAKMETER is compatible with all common hydraulic fluids and fuels. The item under test may be subjected to shock, vibration, or temperature, from which the LEAKMETER remains isolated. The instrument accommodates pressures to 5000 psi. Jacks are provided for recording or other readout.

For Complete Information–or to purchase a LEAKMETER *for Immediate Delivery, Write, Wire, or Phone:*

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in-line Hydraulic Relief Valves to **new specification* MIL-V-8813 (ASG)** for type II systems. Also applicable to type I systems.

MS 28893-A4 **MS 28893-C4**
MS 28893-B4 **MS 28893-D4**

MS 28893-A6 **MS 28893-C6**
MS 28893-B6 **MS 28893-D6**

MS 28893-A8 **MS 28893-C8**
MS 28893-B8 **MS 28893-D8**

***MIL-V-8813 (ASG)** (Supersedes MIL-V-5523B)

- *Higher operating temperatures (275°F)*
- *Lower spread — full flow to reseat*

Especially applicable to auxiliary power system pressure control.

Valve Features: 1. No Dynamic O-Rings, no hysteresis; 2. Dash pot, no noise or chatter; 3. No outlet jet effect; 4. Flow compensated operation; 5. Light wt., low stress springs

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Wiper **Ring**

This patented closed joint ring provides squeeze - grip action, assuring complete contact on the rod at all times. Maintains uniform, continuous pressure on wiper edge. Rods are always clean in any temperatures.

Fall "CJ" Wiper Rings operate most effectively under extreme conditions of dust, glaze, oil, grit, powder, gases, sand, ice, etc. Available in diameters ½" through 13". For any commercial use. Used by military and aviation industry since 1944.

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Est. 1935

Circle **1** on Time-Saver Card

AIRCRAFT COMPONENT DATA

Absolute Pressure Regulators . . . have 40-cfm capacity

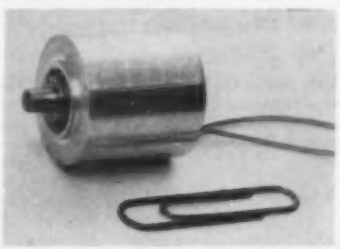
Series 141RR2 regulators maintain air pressures within ½ lb. over normal flow ranges, within ¼ lb. from sea level to 90,000 feet. Set for pressures from 14.7 to 100 psia. For supply pressures from 14.7 to 315 psia, supply air temperatures from —100 to 700 F, ambient temperatures from —100 to 275 F.

Provision for remote sensing of ambient pressure. Optional relief valve provides full relief within 2 psi above regulated pressure. Weight is 1 lb; length, 6.1″; diameter, 2″; out-port extension, 0.6″.—*Consolidated Controls Corp., Bethel, Conn.*

Circle **505** on Time-Saver Card

400-cps, Unrectified Solenoids . . . in two sizes

Operate without rectification. Used singly or stack-mounted. Externally adjustable stroke length. Linear action is push or pull. Model 175 weighs 1.3 oz., uses 13 w.;



Model 375 weighs 5.1 oz., uses 40 w. Both operate continuously at temperatures from —65 to 450 F. —*B. H. Hadley, Inc., Los Angeles 25, Calif.*

Circle **506** on Time-Saver Card

Linear Potentiometer . . . for servo systems

All metal construction. Can be installed inside actuator shaft to

save space. High resolution with linearities to 0.05%. Not sensitive to shock or vibration. Accurate in ambient temperatures to 500 F. Strokes from 1 to 5 inches.—*Edcliff Instruments, Monrovia, Calif.*

Circle **507** on Time-Saver Card

Field-Attachable Fittings . . . are swaged and screw types

Brochure for commercial airline operators covers fittings for tetrafluoroethylene hose. Describes uses of hose assemblies for jet aircraft, grip and seal, burst tests, size, weight, and ease of assembly.—*Resistoflex Corp., Roseland, N. J.*

Circle **508** on Time-Saver Card

Airborne Compressor . . . for fast starting

Designed for jet and turbo-prop planes with fuel air starting sys-

tems. Delivers 8 to 10 cfm. Requires less on time to pressurize reservoir. Large cooling fin area for operating at high temperatures. Equipped with a hydraulic drive motor, it weighs 28¼ lbs.—*The Cornelius Co., Minneapolis, Minn.*

Circle **509** on Time-Saver Card

Valve Data . . . in design booklet

Gives engineering data, characteristics, specifications, and illustrations of bypass, relief, check, regulator, shutoff, measuring and sequence valves. Contains information

to help select valves and actuators. —*United Aircraft Products Inc., Dayton, Ohio.*

Circle **510** on Time-Saver Card

Shutoff Valve . . . for 12,000 psi

Pressure balanced. Requires only 30 in-lb handle torque at 12,000 psi. Body and internal parts of stainless steel. Seals automatically compensate for wear. Panel mounted and can be serviced without disturbing the piping. Five

turns of the handle open the valve fully. Temperature range —100 F to 500 F. Ports are ¾-in. straight thread.—*Robbins Aviation, Inc., Los Angeles, Calif.*

Circle **511** on Time-Saver Card

Cryogenic Pumps . . . have bellows seal

Pumps are close-coupled to electric or hydraulic drive motors. Capacities to 1500 gpm at pressures

to 500 psi. Bellows seal of various metals with sealing faces of carbon, alloys, or ceramics. Temperature range —400 F to 1200 F.—*Hydrodyne Corp., North Hollywood, Calif.*

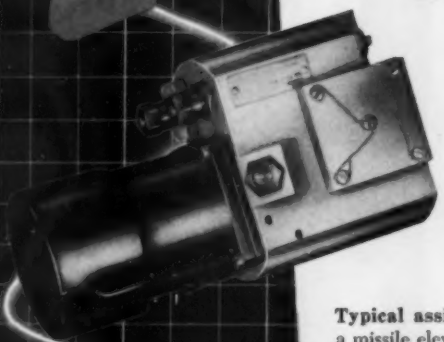
Circle **512** on Time-Saver Card

BUILD ON...

Eastern

CONTROL EXPERIENCE:

SERVO SYSTEMS



Typical assignment: design and develop a missile elevon control servo with a single hydraulic power supply and three actuators. Weight and space considerations critical.

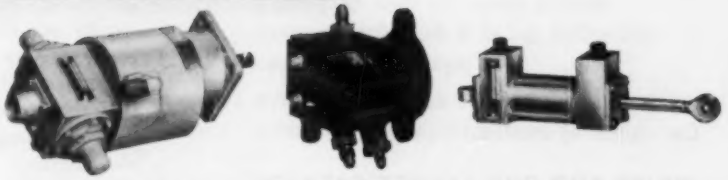
Solution: a system designed and built around the Eastern E/HS 5 type 100A hydraulic power supply, using a 400-cycle motor. Minus motor, but including pump, reservoir, expansion chamber, pressure regulating valve and filter, the supply weighs only 2.6 lbs.

Eastern achieved a 20% saving in hydraulic power supply capacity by the use of one of its own *pulse length modulated* single-stage servo valves, manifolded to each actuator. Zero first stage leakage, zero hysteresis, plus the high response and efficiency which characterize this valve contributed to the successful meeting of the demanding requirements.

Specifications:

force level: 300 lbs.
total stroke: 1/2 in.
max. velocity: 1.5 in./sec.
time constant: 0.1 sec.
max. actuator width: 1.25 in.

For genuine contributions to the solution of your servo problems, call in the Eastern engineer.



servo-valves • fuel controls • actuators

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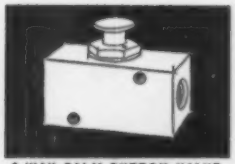
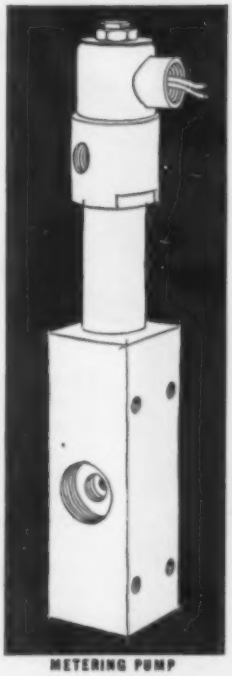


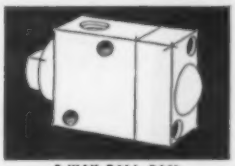
3-WAY PALM-BUTTON VALVE

FOR DEPENDABLE AIR CONTROL ASK FOR



METERING PUMP

airmatic



2-WAY BALL CAM

Whatever your needs—simple or complicated, straightforward or really difficult, in maintenance-free valves and metering pumps like these, or cylinders, combinations and all of the in-line accessories—it pays to ask for Airmatic.

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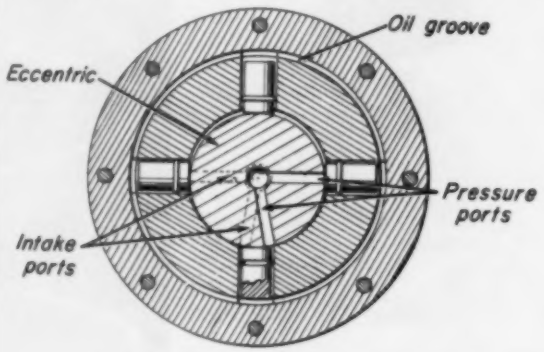
Circle 5 on Time-Saver Card

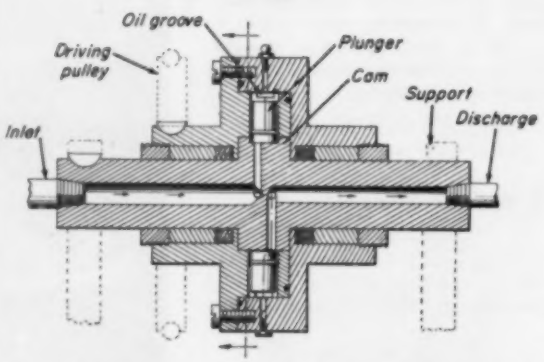
FLUID POWER PATENTS

Pressure-Compensated Pump

Pump has a stationary hollow shaft. The entire pump body rotates around a fixed shaft. Fluid is drawn in at one end and pumped out the other end under pressure.

Before starting, fluid is pumped into the oil groove through the fitting on top of the pump. This fluid





forces the plungers in against the eccentric cam, and sets pump's cutoff pressure.

As the body rotates, the plungers move in and out following the contour of the eccentric cam. The reciprocating motion of the plungers pumps oil in and out through the ports in the eccentric cam. These ports connect to passages in the stationary pump shaft.

Pump cutoff pressure varied by increasing or decreasing pressure in the oil groove.

U. S. Patent No. 2,849,961 *by Paul A. Gawlik, Mission, Texas.*

Pilot Valve

Purpose of the valve is to trigger an unloading valve and make it snap open. It does this by suddenly unbalancing fluid pressures within the valve, with only a slight movement of the valve's control piston.

Continued on page 128

Circle 133 →

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...ANOTHER OUTSTANDING SERIES OF B-W

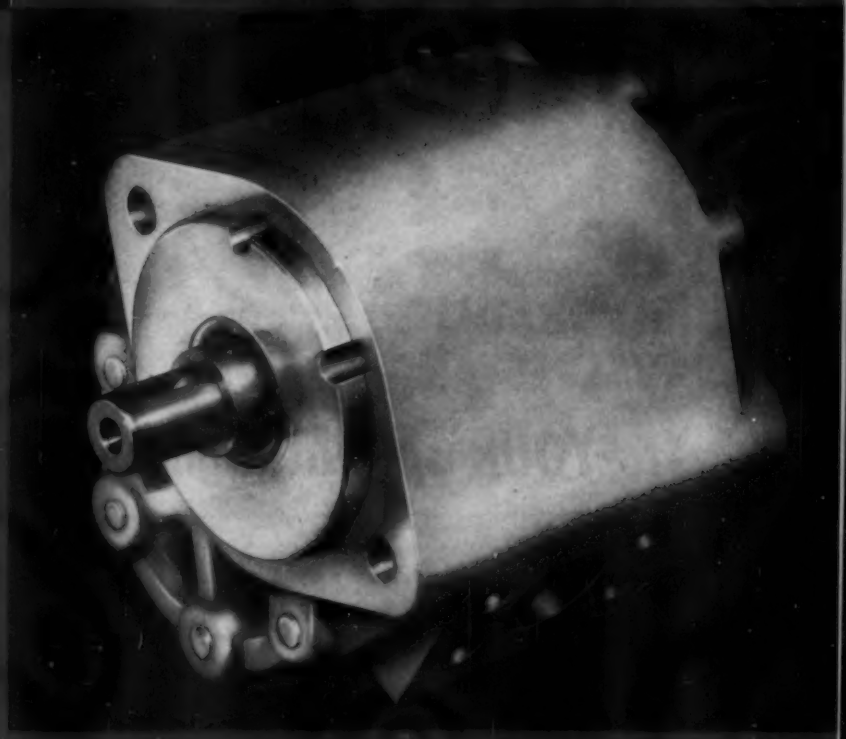
HYDRAULIC GEAR PUMPS

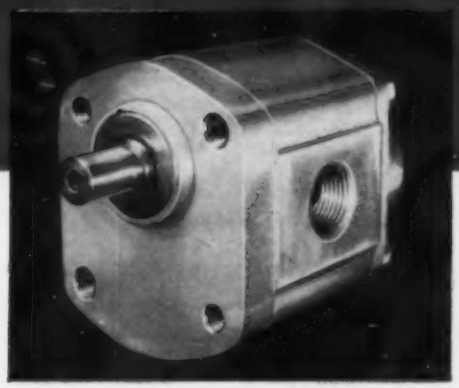
P-3 SERIES

Capacities:
8.0 to 21.0 GPM at 2000 RPM and 2000 PSI

Displacement:
1.0 to 2.7 CU. IN.

(For maximum speeds, consult our engineers)





P-2 Series Previously Announced
Capacities 1.7 to 7.8 GPM at 2000 RPM and 2000 PSI
Displacement 0.2 to 0.9 cu. in.
Speeds to 4000 RPM

SPECIAL FEATURES OF P-3 SERIES

Standard S.A.E. mounting and drive shafts
Optional porting: side, rear or combination
Special alloy tin-aluminum bearings, used in heaviest-duty industrial engines
All bearings interchangeable
Double lip shaft seal
Hardened and ground steel gears and shafts
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B-W

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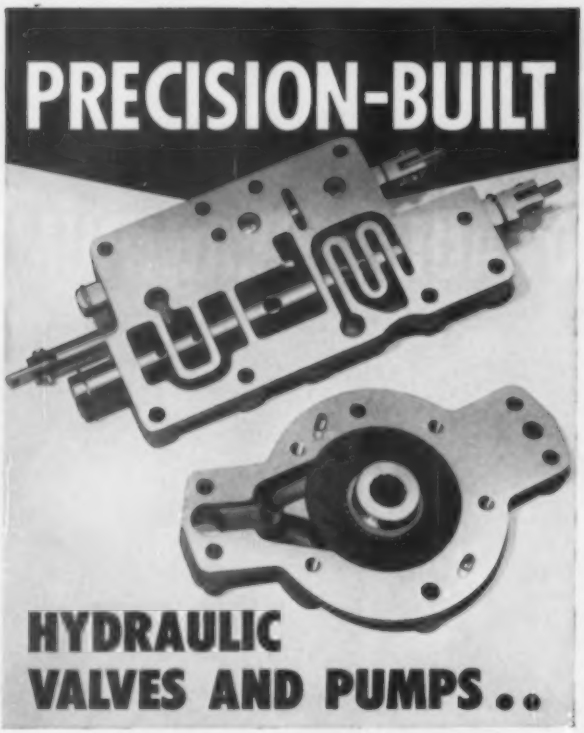

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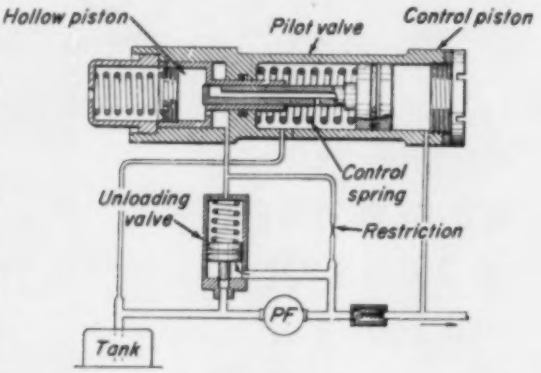
Circle 60 on Time-Saver Card

FLUID POWER PATENTS

In the position shown, pump pressure holds the hollow piston to the left against spring force. The unloading valve is held closed by spring force and pump pressure acting on a larger area on top of its piston than on the bottom.

As system pressure increases, the pilot valve control piston moves left. When the port in its stem opens



into the hollow piston, fluid flows from inside the piston, through the control valve spring chamber, to tank.

Pressure fluid drains from the top of the unloading valve piston through the port in the hollow piston. It returns to tank through the rod in the pilot valve control piston. Pump pressure on the bottom of the unloading valve piston drives it up, unloading the pump.

When system pressure falls, the spring moves the control piston right. This closes the passage from inside the hollow piston to tank. Pressure builds up and drives the unloading valve piston down, closing the unloading valve.

U. S. Patent No. 2,905,432 by Jean Mercier, New York, New York.

Other Patents Issued

FLUID PRESSURE SERVO MOTOR

No. 2,902,006 by Earl R. Price, assigned to Bendix Aviation Corp., South Bend, Ind.

FLOW CONTROL VALVE

No. 2,906,821 by Vernon J. Pillote, assigned to AquaMatic Inc., Rockford, Ill.

SPEED CONTROL VALVE

No. 2,902,050 by William Carls, Milford, Mich.

FLUID MOTOR

No. 2,902,009 by Card Ludwig, Charles H. Wheeler, and Alfred R. Deedman, assigned to Ex-Cell-O Corp.

DECOMPRESSION VALVE

No. 2,904,074 by John Maurice Towler, assigned to Electricaulic Presses Ltd., Rodley, England.

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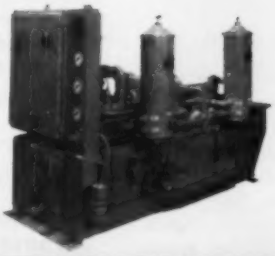

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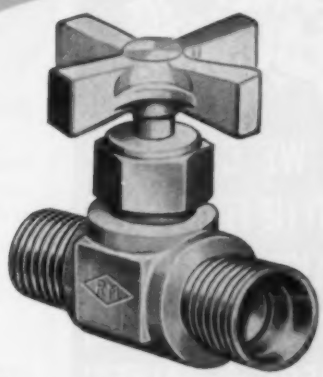

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Circle **123** on Time-Saver Card

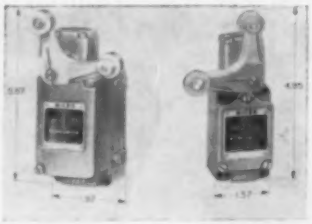
NEW PRODUCTS

Continued from page 46

LIMIT SWITCHES . . . maintain contact

Designation: LS, 200 LS Series

Features: When moved from either extreme, yoke-actuator causes



internal switching unit to transfer and maintain circuit. For automatic reversal of traverse on reciprocating mechanisms. Actuator heads mount in 4 positions, 90 deg. apart. Actuator locks in any position. O-rings seal actuator head assembly. Neoprene rings seal switch enclosures. Sealed conduit. Replace quickly, with no electrical work.

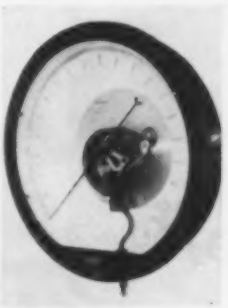
Specifications: 18 switches have capacities of 10 amp., 120, 240, 480 vac.

Micro Switch
Div. Minneapolis-Honeywell Regulator Co.
Freeport, Ill.

Circle **305** on Time-Saver Card

50,000-PSI GAGES . . . to .1% full scale

Features: One-piece, stainless steel tube formed to correct oval section at working portion. This portion is



coiled into helix. Unformed ends serve as gage outlet tube and as bleeder device. Tube rigidly mounted on socket casing. No internal connections.

Heise Bourdon Tube Co.
Newton, Conn.

Circle **306** on Time-Saver Card

4-WAY SERVOVALVE . . . has rectangular ports

Designation: Model CO-5

Features: For follow-up positioning systems. Positional feedback by linkages or by mounting valve on cylinder. Valve can be mounted on slide whose motion is controlled by system's output. Following initial spool displacement, valve body can be moved by slide to new null position. Valve can be used for flow metering. Precision adjustment of valve lap. Spring-offset spool.

Specifications: ¼", Dryseal pipe threads. Straight-threaded connections available. Maximum pressure is 3000 psi. Maximum flow at 15 fs is 6 gpm. Flow sensitivity is 80 gpm/in. at 200 psi valve drop.

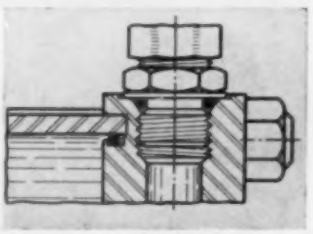
Hydraulic Controls Co., Inc.
Newton, Mass.

Circle **307** on Time-Saver Card

HYDRAULIC CYLINDERS . . . have straight thread ports

Designation: Series H

Features: No distortion from wedging action of pipe thread connection. No pipe dope. Fitting posi-



tioned exactly without overtightening or backoff. No leakage from temperature variance or shock. Rigid connections, since fittings work on full thread surface.

Power Cylinder Div.
Hannifin Co. Div.
Parker-Hannifin Corp.
Des Plaines, Ill.

Circle **308** on Time-Saver Card

GAS BOOSTER COMPRESSOR . . . to 10,000 psi

Designation: Model SS-2

Features: Single, compact unit contains a hydraulically driven booster compressor, hydraulic power unit, and a cycling control. For mobile hydraulic power the equipment has a separate hydraulic power unit mounted on casters and fitted with quick disconnect hoses. No oil or

Continued on page 132

"All the world's Our stage"...

Manufacturers all over the world have discovered the importance of fitting SUPERFECT Oil Seals and Hydraulic Packings for perfect performance under the most exacting conditions.

There is a type of Seal to meet virtually every need. When a new project is in the course of development, our Research Department is available for the SUPERFECT solution to every sealing problem.

A brand new catalogue is in the course of preparation. May we reserve one for you?

SUPERFECT

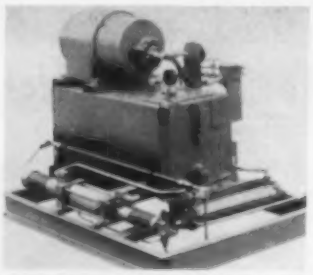
SUPER OIL SEALS & GASKETS LTD.

KINGS NORTON FACTORY CENTRE, BIRMINGHAM 30, ENGLAND

Manufacturers of 'SuPerfect' Hydraulic Packings and 'O' Rings; 'Romet' water pump seals and mechanical pump seals; 'Fidrac' Mechanical rubber mouldings; 'Redcaps' Polythene Protective Caps and Plugs.

NEW PRODUCTS

other conventional lubricant necessary. Compressor rings and composition bearing on the gas piston are made of special glass-filled Teflon which has natural lubricating qualities. Gas is cooled by a water inter and aftercooler. The cycling control contains a pilot-operated 4-way valve, two solenoid-operated, 3-way valves, relay, hourmeter, and other components to cycle booster.



Specifications: Single-acting, two-stage compressor, 16 scfm average gas flow. Hydraulic power units available in pump-motor ratings of 4.8 gpm/7.5 hp, 6.5 gpm/10 hp, 9.3 gpm/15 hp. Pressure to 10,000 psi.

Haskel Engineering & Supply Co.
Glendale, Calif.

Circle **309** on Time-Saver Card

TWIN INDICATOR LIGHT
. . . captive lens prevents dropping

Designation: L5900, standard, and L5910, dual color.

Features: Movable, curved, retaining stud holds lens to case, permits lens to be removed. Miniature lamps held in lens by spring contact finger. Replaced by pulling lens assembly from case. Lights may be wired independently. Lens is broad, has space for engraving.

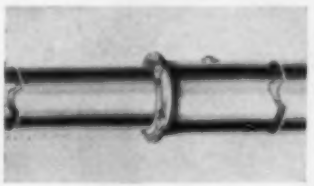
Specifications: Uses MS-327-type miniature lamps. For 6, 14, 28-volt service.

Control Switch Div.
Controls Company of America
Chicago, Ill.

Circle **310** on Time-Saver Card

HYDRAULIC CYLINDERS
. . . custom fabricated

Features: Piston moves on removable precision bronze bearings. Cylinder has top bolt rings for attachment to working surface.



Specifications: Single-acting, pressures to 500 psi, 4" to 18" diameters. Capacities to 75,000 lb. Length to suit application.

The Joyce-Cridland Co.
Dayton, Ohio

Circle **311** on Time-Saver Card

MULTIPURPOSE ANGLE VALVE
. . . stem-support away from body

Designation: No. 74

Features: Liquid-level gage valve. With pipe plug which has integral bleed fitting, valve becomes No.

Capital

HYDRAULIC FILTERS

for Hydraulic and Oil Re-circulating Machinery

Capital Hydraulic Filter Units are smaller than ordinary filters but with filtering capacity equal or superior to many larger filters. Small size permits greater latitude in design, particularly where space is restricted.

Capital Filter Units are designed with one-piece construction — no screws or nuts to work loose and be lost or mislaid. Simple and easy to clean by any method.

Made from specially designed woven Monel wire, with narrow corrugations presenting the greatest filtering area. Monel support supplies extra sturdiness.

Capital Filter Units are made in 4 Types:

- **MONO-BILT 60 Mesh All Stainless Steel (Sump type).**
- **MONO-BILT Standard All Stainless Steel**
- **MONO-ECONO Mono-Bilt with Monel Metal Insert and Cadmium Plated Top and Bottom.**
- **LINE TYPE with Aluminum Housing and Mono-Bilt, one Piece Filter Unit.**

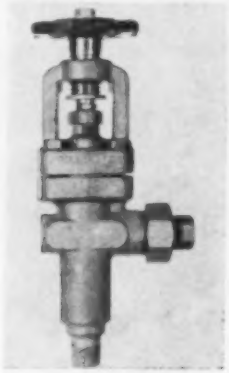
Built from Monel Metal they are impervious to rust and corrosion.

CAPITAL ENGINEERING & MFG. CORP.

5836 SOUTH ASHLAND AVENUE, CHICAGO 36, ILLINOIS

Circle **27** on Time-Saver Card

74G instrument valve. No multiple connections. Bonnet uses forged gland-follower which bears on packing, and is independent of yoke. Stem threads are outside body. Stem goes to and from seat in



straight line. No rotating action. No seat wear from galling. No packing contamination from liquid when valve is open. Allows repacking under pressure.

Specifications: ASA rating is 1440 psi, at 100 F; commercial rating, 4000 psi. Weighs 8 lb.

Jerguson Gage & Valve Co.
Burlington, Mass.

Circle **312** on Time-Saver Card

Continued on next page

Circle **25** on Time-Saver Card

A HANDFUL OF POWER

DOWTY Pressure Balanced HYDRAULIC GEAR PUMPS

Pressures to 2500 PSI • Outputs from 1/2-60 GPM

Shown here is our Model GP2-85 which will deliver 18 GPM at pressures to 2000 PSI. Volumetric efficiency exceeds 95% throughout the operating range. Fully pressurized lubrication independent of discharge pressure. 14 other sizes available.

Berry HYDRAULICS
A DIVISION OF THE OLIVER TYRONE CORPORATION

MAIL FOR COMPLETE DATA

Berry Hydraulics
2227 Oliver Building
Pittsburgh 22, Pa.

Name_____

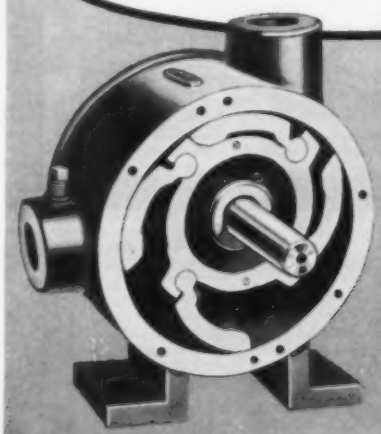
Company_____

Address_____

_____

Here's why LEIMAN AIR PUMPS

Put "Lifetime" Dependability into your Machines!



HINGED, CURVED VANES OF DURABLE CAST IRON

Take up their own wear

Four curved vanes on easy-action hinges scoop up large volumes of air and maintain perfect cylinder wall contact by centrifugal force. Vanes and cylinders are made of durable cast iron (no composition). They hone themselves to hard, glossy smoothness, reducing frictional wear to a minimum. Negligible wear is automatically taken up by rotating vanes. 2 to 3 times more air space is provided.

Typical reports from users:

"Never wear out or give trouble"

"Used 350 pumps without a complaint"

"Pumping 24 hours a day for 21 years"

"12 years without any attention, except lubrication"

•

If the operation of your machines depends on a reliable, steady source of vacuum (suction) or air pressure—install Leiman Air Pumps. They will last for the life of your equipment—providing fully-rated capacity year after year, with little or no maintenance.

The simplified design of Leiman Air Pumps has fewer moving parts—provides greater capacity in smaller pumps to compact your designs. Airflow is smooth—operation extremely quiet. A wide range of models and sizes is available to meet your operating conditions. Experienced engineers are at your service on any design or installation problem.

LEIMAN BROS., INC.
151 Christie St., Newark 5, N. J.
Established 1887

SEE OUR CATALOG IN SWEET'S FILE

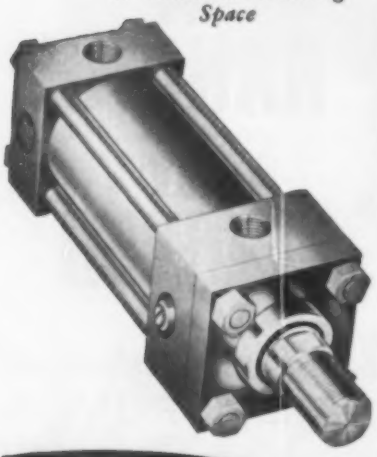
Write for new catalog showing construction, types, sizes and specifications, plus Application Book containing many "how-to-do-it" blueprints.

LEIMAN Rotary Positive **AIR PUMPS**

Vacuum to 29.9" Hg. Pressure to 20 p.s.i.g. Volume to 162 c.f.m.

Circle **85** on Time-Saver Card

Maximum Working Force in Minimum Working Space



Milwaukee
Air or Hydraulic
CYLINDERS

- Quality Construction Throughout
- No Costly Down Time
- Guaranteed Top Performance
- Precision Designed –Heavy Duty Service
- Conforms to JIC Specifications

Get all the facts and see how Milwaukee Cylinders save space and weight . . . Save on original cost and save on maintenance.

Write today for Free Bulletins A-100 and H-100.

Standard Models
Hydraulic Bore Size 1½ to 12"
Air Bore Size 1½ to 14"
Specials built to your specifications

MILWAUKEE CYLINDER CO.
Division of L. & M. Machine Company
5755 SO. PENNSYLVANIA AVE.
CUDAHY, WIS.

8th annual

PRIZE PAPER CONTEST

The purpose of this competition is to recognize and reward achievement in the field of fluid power design and application.

For Rules Booklet
Circle 240
on Time Saver Card

NEW PRODUCTS

PLASTIC HYDRAULIC HOSE . . . reinforced with nylon

Features: Greatly exceeds SAE specifications, first non-rubber hose approved. Nylon gives toughness, abrasion resistance. Special design, metal end fittings.

Tecalemit, Limited
Plymouth, England

Circle **313** on Time-Saver Card

3-STAGE FILTER . . . one micron with low pressure drop

Features: Consists of non-woven material between coarse wire screen (200 x 200) and cellulose sheet. Screen filters large particles and supports center medium. Resin-impregnated cellulose sheet gives additional support, provides final separation of contaminants. Porosity of main filtering medium highly controllable. Contaminants held by adsorption and absorption. Medium stops large quantities of small particles, to less than one micron on hydraulic and pneumatic systems. Mist remover in air-cooling systems. Cleans fluid in hydraulic test stands. For pre-filtering fluid prior to charging system. Collects smoke and odors from pneumatic systems.

Specifications: Sizes from 2 to 10 gpm. Common fluids do not affect filter from −65F to +275F.

Purolator Products, Inc.
Rahway, N. J.

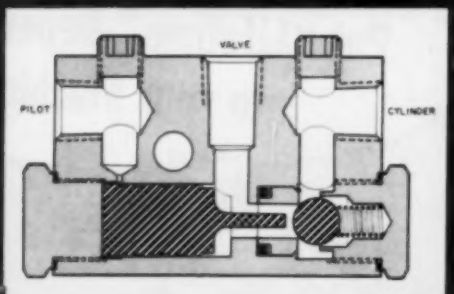
Circle **314** on Time-Saver Card

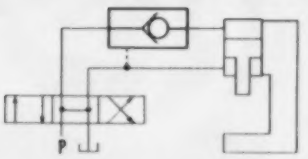
Continued on page 136

Positively Lock Circuits Or Cylinders...Until Released

PILOT CHECK VALVES

- For clamping or holding circuits
- Allows use of inexpensive control valves
- Long trouble-free service





- Standard Ports — ¼" and ½" pipe (NPTF)
- For oil to 3000 psi

Write for detailed information

Fluid Controls, inc.
Member of National Fluid Power Association

Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

Circle **43** on Time-Saver Card

Circle **7** on Time-Saver Card

new ROTORAM® VALVES

WITH EXCLUSIVE ROTATING STEM

for MILLIONS of TROUBLE-FREE ACTUATIONS

Treadle Valve

Knob Valve

Cam Valve

Finger Valve

Pedal Valve

Hand Ball Valve

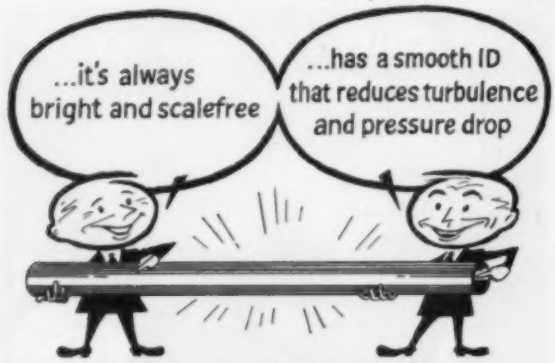
- Low silhouette mounting
- 2024 T4 aluminum bar stock
- Rust-resistant
- Full flow air passages
- Piped exhaust ports
- Interchangeable parts
- Anodized finish

Rotoram Valves are available in 3 and 4-way models for ⅛", ¼", ⅜" and ½" pipe sizes. Special Block "V" Packing permits free ram movement, insures long valve life. Port entry from either left or right side. Ask your AIR-MITE Distributor, or write for complete details and illustrated catalog.

AIR-MITE DEVICES, INC.

4401 W. Kinzie St., Chicago 24, Ill.

TubeXperience in Action



And here are 8 more reasons why Superior (SAE) Hydraulic Steel Tubing is your best buy

- *Ease in bending and flaring*, with no loss of ductility in storage and service, through use of 0.12% max. carbon content nonaging steel
- *Consistently uniform tubing* through careful inspection of raw material and tubing in process
- *Assured cleanliness* by hot solvent degreasing before all process anneals and shipment
- *Flare-inspected quality* based on 35% increase of OD
- *100% hydrostatic testing* to recommended working pressures
- *Rust preventive treatment* of all tubing before shipment
- *All tubing boxed and wrapped* for cleanliness and to protect against bending and denting during shipment or in warehouse storage
- *A complete range of sizes* stocked by leading steel service centers

FREE! Bulletin 39, which contains bending data, working and bursting pressures and flow information. Write Superior Tube Company, 2030 Germantown Ave., Norristown, Pa.

Superior Tube

The big name in small tubing

NORRISTOWN, PA.

All analyses .010 in. to ⅛ in. OD—certain analyses in light walls up to 2½ in. OD

West Coast: Pacific Tube Co., Los Angeles, Calif. • FIRST STEEL TUBE MILL IN THE WEST

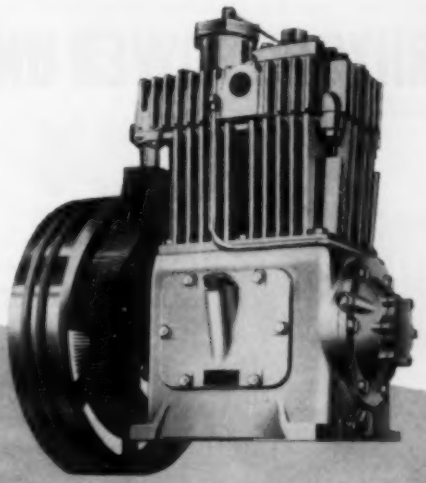
Circle **120** on Time-Saver Card

---

1 more good reason to think about *Quincy*

CUSHIONED STEEL VALVES assure extremely quiet operation for QUINCY COMPRESSORS. Each valve and seat is a separate assembly that can be removed for inspection without disturbing the other valves.

Designed by engineers who have pioneered air compressor advances for 40 years, each QUINCY is built to provide maximum service efficiency and long life. Cushioned steel valves are only 1 reason for QUINCY'S outstanding performance. Lynite connecting rods, automotive type pistons, Safe-Q-Lube pressure lubrication and Loadless Starting all contribute their functions and quality to the overall performance of QUINCY COMPRESSORS. The point is simply that you can count on a Quincy — for *years*. CHECK THE "Q-LINE" NOW — a complete range of industrial models for all applications.



Quincy COMPRESSORS

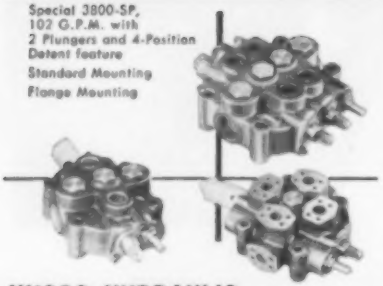
QUINCY COMPRESSOR CO., Quincy, Illinois

Makers of the World's Finest Air Compressors

Circle **101** on Time-Saver Card

Circle **62** on Time-Saver Card

New Multi-Position, Power-Saving FLUID CONTROL



HUSCO HYDRAULIC MULTI-PLUNGER VALVES

HUSCO Valves give you up to FOUR Control Positions — Raise, Lower, Float and Neutral, with or without Detent — for unusual advantages in versatility and performance. Available to control up to SIX cylinders, single or double acting, with Power-Saving Relief Valve. Capacities from 3 to 185 G.P.M.. Over 120 standard models, with unlimited modifications to fit your specific need.

Get the whole story of HUSCO Features and advantages. Write for your copy of HUSCO'S "House of Ideas" — and engineering aid on your control needs.

HYDRAULIC UNIT SPECIALTIES CO.

PUMPS • VALVES • CYLINDERS

P. O. Box 257-A, Waukesha, Wisconsin

West Coast Representatives

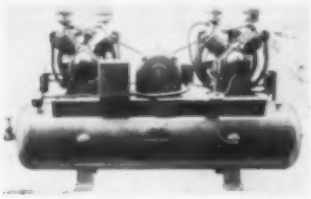
EASTMAN PACIFIC CO., Los Angeles, Calif.

ROY BOBBS AIR-DRAULIC CO., Portland, Ore.

NEW PRODUCTS

AIR COMPRESSORS
. . . driven by single motor

Designation: OE-36-15, OE-36-20.



Features: One motor drives two model RE-36 pumps. Two belts for each pump.

Specifications: Length 95", width 28", height 54". Maximum working pressure, 200 psi. Displacement: OE-36-15 (15 hp), 76 cfm at 100 psi, 63.4 cfm at 200 psi; OE-36-20 (20 hp), 96 cfm at 100 psi, 80 cfm at 200 psi. 120-gallon tank.

Champion Pneumatic Machinery Co.
Princeton, Illinois

Circle **315** on Time-Saver Card

SELF-SEALING SCREWS
. . . have O-ring

Designation: Uniseal Captive.

Features: For pressurized covers, panels, and cases. Reusable. Thin Teflon washer protects O-rings in head groove. Always metal-to-metal contact. Seals against wide variety of media, temperatures, and pressures.

Aero Bolt & Screw Co., Inc.
Inglewood, Calif.

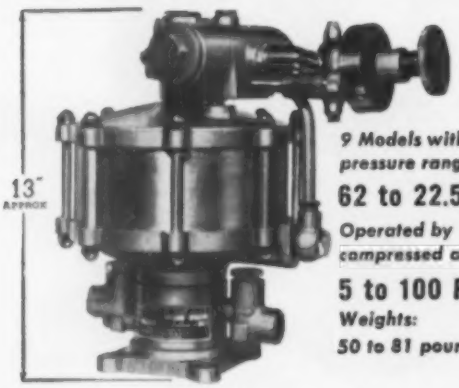
Circle **316** on Time-Saver Card

TUBE OR HOSE BAND CLAMP
. . . has separate mounting tab

Designation: Wedge Lock Band Clamp.

Features: Tab is added to clamps where tube, hose, wire, cable will

AIRHYDRO POWER UNIT



9 Models with pressure ranges:

62 to 22,500 PSI

Operated by compressed air from

5 to 100 PSI

Weights:
50 to 81 pounds

FOR PRESSES, JACKS, LOADED ROLLS, ETC. . . .

- **Low Unit Cost . . . Easily Installed**
- **Accurate, Reliable . . . Negligible Upkeep**
- **Maintains static pressure using no air**
- **Non-corrosive . . . Uses water or oil**

FOR PRESSURE TESTING

35 Models single and double acting standard Airhydropumps . . . and 6 Junior Models

DAVIES BROS. GLADSTONE, NEW JERSEY

Circle **35** on Time-Saver Card

Just Out! Just the ticket to cut cost!

Ross CUB

NEW SPEED CONTROL VALVE

⅛" and ¼" pipe sizes in stock now!

Now a speed control valve that regulates your cylinder movement with precision and sureness, but which lists at $3.00 and $3.25. And despite its lower costs, "CUB" features the same high quality of design and workmanship you've come to expect from Ross. "CUB'S" design stresses trouble-free operation and easy maintenance. CUB is small, aluminum and lightweight. If you use speed controls, by all means call your Ross representative or write us.

Ross OPERATING VALVE CO.

105 E. Golden Gate Ave. • Detroit 3, Michigan

Circle **112** on Time-Saver Card

be supported. Or tabs can be premounted to simplify planning. Clamp and lines attached later to tab. Slides around clamp to any position. Ratchet teeth on band and wedge provide vibration-proof holding. Released only by cutting.

Specifications: All nylon. One size for holding ⅛" to 1¾" diameters.

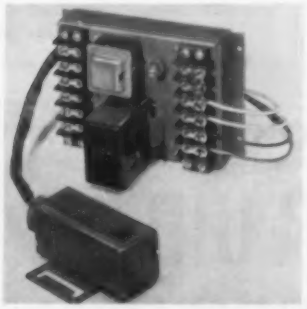
Weckesser Co.
Chicago, Ill.

Circle **317** on Time-Saver Card

PROXIMITY SWITCH
. . . detects magnetic material without physical contact

Designation: Sensor TJ311A. Amplifier (including relay) RJ307A.

Features: Consists of sensor and amplifier with plug-in relay which is wired in circuit same as limit switch. Sensor may be 150 ft from amplifier without use of shielded wire. Sensor is sealed, face is stainless steel, withstands abrasion, has no moving parts. Detects variety of shapes without detaining parts flow, to 700/min.



Specifications: Amplifier input, 105 vac, 60 cycle. Sensor is 1.63" x 1.63" x 3.75". Adjustable sensitivity range ⅛" to ½".

Micro Switch Div.
Minneapolis-Honeywell Regulator Co.
Freeport, Ill.

Circle **318** on Time-Saver Card

TEFLON PIPE GASKETS
. . . template simplifies installation

Designation: Task-Line.

Features: Each gasket is packaged with a disposable cardboard template for easily positioning the gasket on the flange. Cold flow of the Teflon is eliminated by perforated steel within the gasket. Will not creep or blow out, Reusable.

Specifications: For 150 psi. Flange pipe sizes ½" ¾", 1", 1½", and 2" in 1/16" and ⅛" thicknesses. Special thicknesses to order.

Modern Industrial Plastics Div.
The Duriron Company, Inc.
Dayton, Ohio

Circle **319** on Time-Saver Card

COUPLINGS
. . . simplified design

Designation: Junior Series, 3J, 4J, 5J.

Features: Only three components, rubber sleeve and two flanges cast from zinc alloy. Molded teeth of sleeve lock into teeth of flange without clamps or screws, tightening under torque. No metal-to-metal contact, no wear on flange teeth.

Specifications: Bore sizes and peak horsepower ratings at 1750 rpm: 3J, ⅜" to ¾", 1.5 hp; 4J, ½" to 1", 3.0 hp; 5J, ⅝" to 1⅛", 6.0 hp. Zinc alloy AG40A, 41,000-psi tensile strength.

T. B. Wood's Sons Co.
Chambersburg, Pa.

Circle **320** on Time-Saver Card

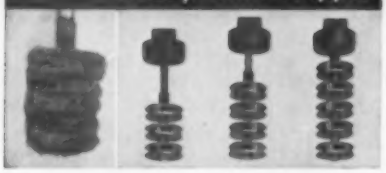
Continued on next page

ON THE JOB...
with CROSS
HYDRAULIC CYLINDERS
Stay "on the job" with dependable, rugged Cross Hydraulic Cylinders. Like Cross customers everywhere, you too, will appreciate the fast, courteous, dependable service you get from Cross. Phone for speedy delivery on any quantity...quality-built to your specifications. Contact Cross Engineering Department, today!
■ RUGGED
■ DEPENDABLE
■ ECONOMICAL
CUSTOM DESIGNED CYLINDERS FOR EVERY APPLICATION
Try CROSS CYLINDERS in your operation... low cost, dependable, and trouble free.
Lowest-Priced Engineered Quality Cylinders Available..
trade mark of Quality in Hydraulic Cylinders...
HYDRAULIC CYLINDERS
CROSS
CROSS MANUFACTURING CO.
LEWIS, KANSAS – PHONE EA 4-5525
WRITE • WIRE • PHONE...TODAY!!

Circle **33** on Time-Saver Card

Circle **68** on Time-Saver Card

NEW MAGNETIC CLEANER for HYDRAULIC POWER UNITS the Kebby Tank-Trapper



★ Powerful Alnico V Magnets
★ Highest Active Area
★ Engineered for Power Concentration
★ Easy to Apply
★ Low Priced . . . Quick Delivery
★ No Moving Parts . . . No Maintenance

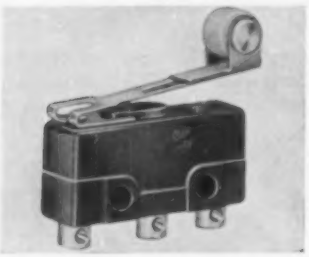
MEETS NEW J.I.C. HYDRAULIC STANDARDS

The Kebby Tank-Trapper is specifically designed to complete the protection of hydraulic systems against damage by iron particles worn off moving parts of various components. It picks up material missed by the filter and prevents premature filter loading. Expensive shut downs and service calls are drastically reduced. Write for Bulletin 1-500-59.

THE KEBBY COMPANY
2320 Custer Avenue Rockford, Illinois
Designers and Manufacturers of Magnetic Devices, Kebby Mite and Filtray Coolant Cleaners

NEW PRODUCTS

SUBMINIATURE SWITCHES . . . with integral actuator



Designation: Leaf or roller leaf actuator riveted to top of plastic case. Saves space, shortens assembly time. Suited for ganging in cam-actuated and limit switch applications when multiple switching is desired.

Specifications: Leaf actuator 25/32" long x 35/64" high x ¼" deep. Roller leaf ¾" high. 6-oz maximum operating force. Electrical ratings 5 amp resistive, 3 amp inductive at 30 vdc and 125 vac. Temperature range —65F to +250 F. Meets MIL-S-6743 and Procedure II of MIL-E-527 2A for vibration.

Haydon Switch, Inc.
Waterbury, Conn.

Circle **321** on Time-Saver Card

TUBE FITTINGS . . . for shipboard use

Designation: Ferulok LHBU union

Features: Flareless tube end, both ports. Groove in fitting allows use of AN6290 O-ring fitting gasket for leakproof mounting in straight-thread boss.

Specifications: In 16 new combination or reducing sizes. For ⅛"-2" tube OD.

Parker Fittings & Hose Div.
Parker-Hannifin Corp.
Cleveland, Ohio

Circle **322** on Time-Saver Card

Continued on page 140

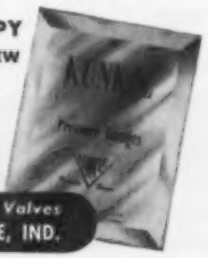
KUNKLE GAUGES
FOR PROCESS & POWER INSTRUMENTATION

KUNKLE GAUGES

Complete, broad range line makes gauge application-specification easy with assured results backed by 50 years of gauge manufacturing experience.

Ranges from 15 p.s.i., or 30" of vacuum, to 20,000 p.s.i.
Bourdon tubes of bronze, drawn or bored s/s, and other alloys

YOUR COPY SHOWING NEW GAUGES AND SPEC. DATA NOW AVAILABLE WRITE:



By the makers of dependable Kunkle Valves
KUNKLE VALVE CO. · FT. WAYNE, IND.

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Wiley BOOKS

FLUID POWER CONTROL

Edited by JOHN F. BLACKBURN, *Raytheon Co.*, GERHARD REETHOF, *Vickers, Inc., and* J. L. SHEARER, *M.I.T.*

This new book is based on research and development on challenging systems problems, many in the guided missile field. It covers fundamentals, devices, dynamic analysis of fluid systems, electronic analogues, and pneumatic servomechanisms, and includes dynamic response characteristics of components, stressing load effects.

1960. 710 *pages.* $17.50

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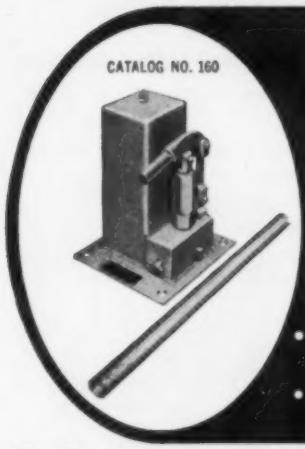
JOHN WILEY & SONS, Inc.
440 PARK AVENUE SOUTH, NEW YORK 16, N. Y.

Circle **98** on Time-Saver Card



Hand Hydraulic Pumps

- Single and Double Designs to 20,000 psi
- With or Without Reservoir

160 cubic inch reservoir with 8"x 8" base plate and 18" long handle.

Available with optional size pistons ⅜", ½", ¾", 1" and 1½".

We specialize in the manufacture of hand pump units which operate in temperatures from −65° F. to +160° F. and with any capacity reservoirs required. Pumps can be furnished on special order with custom seals to handle various aircraft types of fuels such as Pydraul, Skydrol, Oronite, etc.

The single pump with ½", ¾", 1" or 1½" piston is now available in stainless steel.

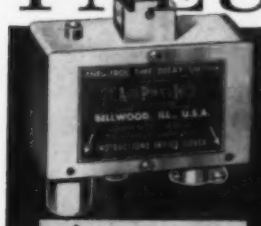
for additional information write:

WILLIAM S. PINE

hydraulic hand pumps for 1001 uses

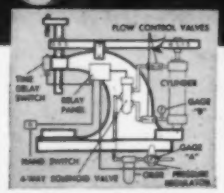
1635 East 22nd St., Los Angeles 11, Calif.

PNEU-TROL



AUTOMATION TIME DELAY SWITCH

FOR CONTROLLED TIME DWELL OF AIR OR HYDRAULIC CYLINDERS



Arbor press converted to high production power press, using double end cylinder, Time Delay Switch, Flow Control Valves, and related equipment, Flow Valves permit independent ram speed adjustment in both directions. Differential pressure between "A" and "B" gages caused by throttling effect of Flow Control Valve creates time interval in working pressure build-up, which is compensated for by Time Delay Switch setting. This insures consistently accurate working pressure on the ram.

- **Holds dwell accurately to fraction of second**
- **Automatically re-sets**
- **Designed for millions of actuations**

Pneu-Trol Time Delay Switch will hold any cylinder controlled motion or operation at a positive stop on either end of the stroke for ¼ to 60 seconds in 20 to 1 ratios. Simple, easy to adjust. Automatically re-sets after each actuation. Positive, controlled time dwell permits wider use of air or hydraulic power in automatic operations, increases accuracy of work by insuring split-second accuracy of time dwell. Available with many thrust linkages for left and right, down, up, or horizontal thrust. Write for Special Bulletin TDS-59

AUTOMATION AUTO-PONENTS INC COMPONENTS

2919 GRANT STREET

BELLWOOD (Chicago Suburb) ILLINOIS

Circle **16** on Time-Saver Card

Barksdale AIR-SEAL* Valves for the nerve centers of production

**** The air pressure is the sealing force; the higher the pressure, the tighter the seal.***

DIRECT SOLENOID 4-way, 3-way, shut-off and diverter valves

◆ Standard **AC**

Explosion-proof **AC** ◆

◆ Standard **DC**

Explosion-proof **DC** ◆

SOLENOID-PILOT 4-way and 3-way valves

◆ Standard **AC**

◆ Standard **DC**

Explosion-proof **AC** ◆

Explosion-proof **DC** ◆

MOMENTARY CONTACT solenoid-pilot valves

◆ Single Solenoid

Both types available in standard AC and DC and explosion-proof AC and DC.

Dual Solenoid ◆

MANUAL OVERRIDES for standard solenoid-pilot valves

◆ "L" type manual override

"MK" type manual override ◆

MANUAL and FOOT OPERATED valves

Manual 4-way

Manual shut-off

Foot operated 4-way

Write for air valve catalog (AV-9) which contains complete data and prices on 562 different valves (not counting voltage variations).

CONTROL VALVE DIVISION

barksdale valves

5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

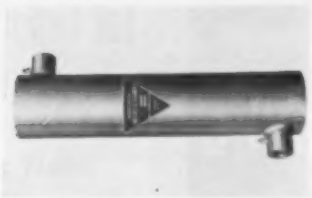
Circle **21** on Time-Saver Card

NEW PRODUCTS

2 TO 5-MICRON FILTER
. . . has low pressure drop

Designation: Contamination Control Pac.

Features: Fabricated of aluminum and stainless steel. Filter media removable, cleanable. Use in low pressure side, holds contamination to 2-5 microns.



Specifications: Sizes, 10 and 25 gpm, 200-psi pressure.

George L. Nankervis Co.
Detroit, Mich.

Circle **323** on Time-Saver Card

NEW

H-P-M 4-WAY VALVES

with Smoother Acting,
Longer Lasting Oil-Immersed Solenoids

These new H-P-M pilot operated 4-way valves are completely interchangeable with industry standards. They feature oil-immersed solenoids to lessen shock and reduce pounding and wear. They last 20 to 30 times longer than air-gap types. Cost? . . . only a few dollars more than conventional air-gap solenoids, a small investment for better machine operation and longer, maintenance free service.

AVAILABLE FROM STOCK FOR IMMEDIATE DELIVERY

¾" Pilot operated, solenoid controlled; 3000 psi, 20 gpm.

NEW

H-P-M RELIEF VALVES

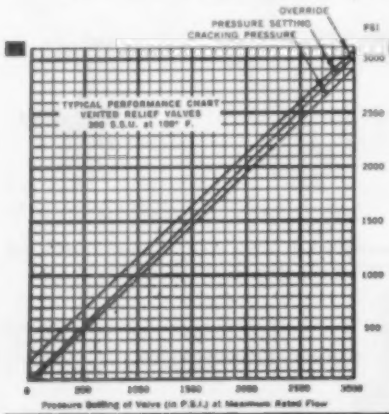
Low override
High Cracking Pressures

Close control of cracking and override pressures is graphically illustrated in the performance chart. These valves are built to protect the circuit from harmful over pressure conditions, assure accurate application of pressures to desired preset requirements and to conserve horsepower.

AVAILABLE FROM STOCK FOR IMMEDIATE DELIVERY.

Completely interchangeable with industry standards.

⅜", ¾", 1¼" Sizes; 3000 psi, 0 to 65 gpm



H-P-M CYLINDERS
300 to 3000 psi
1½" to 12" Bore, standard. Specials built to specification

H-P-M PUMPS
Variable Displacement
5 to 185 gpm
3000 psi max.

HPM HSO

THE HYDRAULIC PRESS MFG. COMPANY

A Division of Koehring Company, Mount Gilead, Ohio, U.S.A.

Circle **61** on Time-Saver Card

DIAPHRAGM CONTROL VALVES
. . . use Teflon packing

Designation: Bantam Series 2020, 2030, 2031.

Features: Compact, save weight and space. Low hysteresis, fast response.

Specifications: 2020 has 8, 15, or 50-sq in. reverse or direct- acting operators. Rated for 300-psi liquids

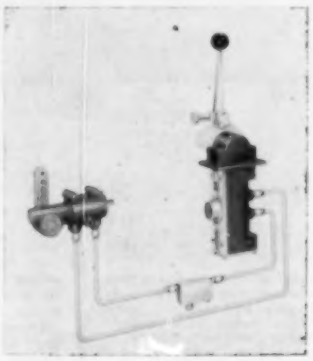
and air. 2030 is similar except for reverse-acting plug. 2031 is 3-way valve for diverting blending, or selecting.

George W. Dahl Co., Inc.
Bristol, R. I.

Circle **324** on Time-Saver Card

REMOTE CONTROL
. . . has vernier adjustment

Features: Manually-operated, hydraulic linkage for positioning, controlling, and duplicating movement.



Controls valves, clutches, brakes, throttles, transmissions, feed mechanisms, and engines on test stands. Master unit lever is positioned and locked. Vernier adjustment then permits lever travel of ±5 deg. Master units available with lock only.

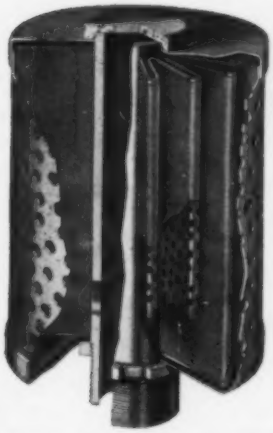
Hydronic Corp.
Detroit, Mich.

Circle **325** on Time-Saver Card

Circle **6** on Time-Saver Card

NEW SUMP OIL FILTER

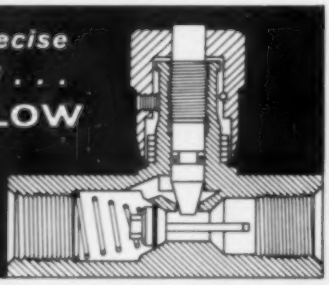
for hydraulic and lube oil systems



● Screen wire mesh reinforced by pleated perforated metal provides greatly extended filtering area. This results in lower pressure drop, larger dirt capacity. Entire unit protected by perforated cover to prevent accidental damage. A wide choice of bronze, monel, or stainless media provides various degrees of positive filtration. Capacities from 1 to 100 gpm, male or female connection. Write for Specification Sheet OCO-1057. Air-Maze Corporation, Cleveland 28, Ohio. Department AH-4. (Subsidiary of ROCKWELL-STANDARD Corporation)

For more precise Flow Control . . .

COLORFLOW FLOW CONTROL VALVES



. . . with exclusive color and number calibrated adjustment

- **Simple reading, recording, setting and adjusting**
- **Safe — adjustable under pressure**
- **Setting can be locked to hold adjustment**
- **Extremely sensitive — provides high flow and minimum pressure drop**

- **For oil, gas, vacuum, water and other fluids**
- **Pressures: Brass to 2000 psi Steel to 5000 psi**
- **Sizes: ⅛, ¼, ⅜, ½ and ¾" dry seal pipe threads**

Write for detailed literature

THE MANATROL Corp.
2372 W. 7th St. • Cleveland 13, O. • CH 1-0575

Circle **79** on Time-Saver Card

3 CLASSES

OF PRESSURE GAUGES meet all service demands

1.

◀ ASHCROFT DURAGAUGES. The finest pressure gauges built—highest in sustained accuracy and durability. Ideal for the toughest services. Save many times their initial cost in replacements and repairs.

2.

ASHCROFT QUALITY ▶ GAUGES. Tops in general-purpose gauges — second only to the Duragauge. Available for pressure, vacuum or compound services in low, medium, and high ranges.

3.

◀ ASHCROFT STEEL CASE GAUGES. None better for small equipment like portable compressors, pumps, and for less important pressure lines. Pressure, vacuum, and compound ranges available.

Ashcroft dial sizes range from 2" through 24" . . . pressures from 30" vacuum or a few ounces up to 100,000 psi . . . materials to suit the application. Among the many Ashcroft Gauges are Maxisafe®, pneumatic receiver, recording, chemical, special purpose types, and various gauge testers. Invest wisely. Make your selection precisely for the job. Chose from the complete line of Ashcroft Gauges. Write for Catalog 300 B.

ASHCROFT PRESSURE GAUGES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Divison • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ont.

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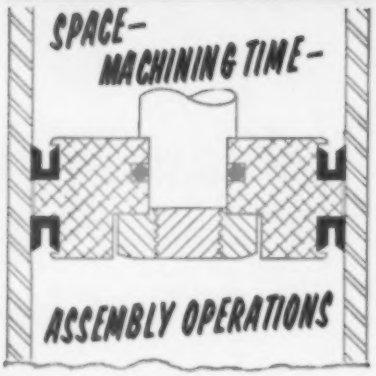
PALMETTO® U-RINGS SAVE...

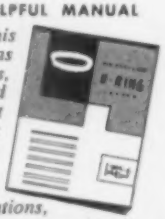


Now widely used where cup or V-packings were required, Palmetto U-Rings are effecting important savings for designers and builders of hydraulic and pneumatic equipment. Their compactness, versatility, strength and durability permits the use of simple, one-piece pistons . . . eliminates glands, backing plates, and their accessory fittings. Savings in space, machining time, and assembly operations are obvious.

Palmetto U-Rings seal with extremely low friction. There is no opportunity for binding due to over compression. Rugged, rectangular design Palmetto U-Rings (greater height than cross-section width), are more stable than square rings, resist rolling or twisting in piston groove.

Palmetto fabric reinforced U-Rings are available for use where clearances are larger, pressures are higher, or greater strength is required, as in hydraulic service . . . Also available in homogenous rubber for use where clearances are smaller and where pressures are below 500 psi, as in air service. Both styles are designed to snap over a retaining lip and into the packing groove of simple one piece pistons.

SEND FOR THIS HELPFUL MANUAL



Just published, this useful literature has tables, specifications, recommendations and other data of interest to design men. Ask for your copy of UR-160. For any assistance — compound recommendations, design help –contact us immediately.

GREENE, TWEED & CO.

NORTH WALES, PA.

See us at Booth 336, Design Engineering Show New York Coliseum, May 23-26

Circle **49** on Time-Saver Card

POST SCRIPTS OF INDUSTRY

News about people, manufacturers and sales organizations

Cain elected president of Greer Hydraulics

John F. Cain has been elected president of Greer Hydraulics, Inc. He has been controller, treasurer, general manager, and executive vice president of the firm. He will handle Greer's new, expanded program on the West Coast. Now at New York International Airport, Jamaica, Greer is moving its facilities to a new plant and offices in Los Angeles. The company will maintain a New York sales-service office.

Roper assigns Hoskinson, opens Rockford office

J. M. Hoskinson, vice president, sales, of Roper Hydraulics, Commerce, Georgia, has been named

Hoskinson

Kiegel

district sales manager for Connecticut, southern New York, and New Jersey. He joined the Roper pump division in 1939. Roper has chosen J. H. Kiegel to manage its new district sales office in Rockford, Illinois. The office has been given the northwestern Illinois territory. From 1953, Kiegel was a sales engineer in the home office sales department.

Skinner forms advertising department

The Skinner Chuck Co. and its Electric Valve Division are served by a new, company advertising department. Ralph W. Gage is manager. He was advertising and sales promotion manager of NICAD, Division of Gould-National Batteries, Inc.

Mitchler heads New York sales for Marsh Instrument

Harold H. Mitchler has become district manager of the New York office of Marsh Instrument Co., Skokie, Ill. The office serves New York and the metropolitan area.

Mitchler

Cummings

Cummings is field engineer for Denison Engineering

Ernest W. Cummings has taken a sales engineering post with Denison Engineering Div., American Brake Shoe Co., Columbus, Ohio. He will work out of the Pittsburgh, Pa., office, which is assigned territory in western Pennsylvania and West Virginia.

Ball resigns Chicago-Allis presidency

Edward H. Ball has resigned as president of Chicago-Allis Mfg. Corp. He is now chairman of the board and chairman of the executive committee. Ball was president for forty-one of his fifty years with the firm. He was president of the American Leather Belting Association, and a director of the National Industrial Leather Association. His son, Edward H. Ball, Jr., succeeds him.

Continued on page 144

Circle **48** on Time-Saver Card

ROTARY AIR GAST PRODUCTS

Runs without oil —

Model 3040 Oil-less Air Pump. Vac. to 20", pressure to 10 p.s.i. To 24 c.f.m., ¾ to 1½ h.p.

Oil-free air blast with carbon-vane

GAST AIR PUMPS

Other Oil-less Models

Built in six smaller sizes, some with integral motors — 1/12 to ⅓ h.p.

Need compressed air that's *absolutely free* of oil mist? A Gast Oil-less Air Pump may be your answer! Air flow *can't* contain oil vapor, because no oil is used.

You also eliminate lubrication problems when vacuum or pressure pump is mounted in a hard-to-service location.

Four carbon vanes lubricate themselves. Ball bearings are grease-sealed for life and separated from pump chamber by a ventilated space. Built in 7 models.

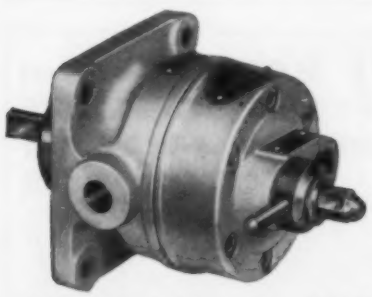
See Catalog in Sweet's Design File

Write for Oil-less Bulletins 152A and VP-356. GAST MANUFACTURING CORP., P.O. Box 117-D, Benton Harbor, Michigan.

GAST ROTARY

- AIR MOTORS TO 7 H.P.
- COMPRESSORS TO 30 P.S.I.
- VACUUM PUMPS TO 28 IN.

"Air may be your answer!"



Accurate Control of Fluid Motion

HYDRAULIC FEED AND PRESSURE LUBRICATION

for
MACHINE TOOLS
TEXTILE MACHINERY
ETC. ETC.

Savery

HYDRAULIC PUMPS

THOMAS SAVERY PUMPS LIMITED
BRACEBRIDGE ST., BIRMINGHAM, 6 ENGLAND

American and Canadian Agents:—
DAVIES BROTHERS, Gladstone, New Jersey, U.S.A. PEapack 8-1290

Circle **113** on Time-Saver Card

HOKE Flow Sheet

HOKE REPORTS ON FLUID CONTROL (1)

HOKE'S NEW PLASTIC STEM TIPS END CHRONIC FAILURE PROBLEM

Galling and scoring valve seats plagued valve users and manufacturers for years, until somebody thought of using plastic stem points. This idea worked well at low pressures, but when the pressure increased — poof! — the valve blew its tip. Up to now, this problem had continued to bother valve makers.

Fortunately, a die-hard Hoke engineer insisted he could put a permanent plastic tip on a high pressure valve. We gave him his head and he gave us a plastic-tipped valve-stem (using either Kel-F or Nylon). His unique design incorporates a crimped metal shell that grabs the plastic tip and *really* holds!

Not satisfied with this monumental accomplishment, he proceeded to tackle leak problems at the stem packing. He put an O-ring seal on the stem and compressed it with a newly-designed Nylon collar. The collar serves a dual role, for it also prevents grit and other foreign matter from chewing up the O-ring. Valves of this new design have performed successfully up to 3500 psi. Our die-hard engineer not only ended galling, but also seat leakage, stem leakage and wear problems — all at one swoop.

There's only one feature about this new development that worries us — since we do not expect replacements we may have designed ourselves right out of the valve business! We make these little dandies of either forged brass, bar stock or 316 Stainless, with ⅛" and ¼" male connections. Temperature limit is 400° F. For the complete story, write, wire, phone or we'll come see you.

WHAT GOES WITH WHAT?

This is a question engineers and chemists are constantly asking each other. Not that we want to do away with this healthy interplay at the water cooler, but we have put together a slide rule that answers all these questions. It lists 22 metals and materials and their degree of resistance to 247 corrosive agents.

Got yours? Write now while there are a few (thousand) left.

HOKE, INCORPORATED
87 Piermont Road, Cresskill, N. J.

Send me complete information on the Hoke products checked below:
☐ Plastic Stem Tips ☐ FREE Corrosion Slide Rule ☐ Have a salesman call

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ STATE_____

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Circle **91** on Time-Saver Card

ENGINEERS

GET THIS HELPFUL HANDBOOK ON OPW-JORDAN CONTROL VALVES WITH SLIDING GATE SEATS

It shows complete engineering data, cutaway drawings, sample specifications, capacity charts and application information. Sliding Gate Seats fully explained.

WRITE TODAY.
ASK FOR HANDBOOK J-170.
170-1

OPW-JORDAN 6013 WIEHE ROAD CINCINNATI 13, OHIO

POST SCRIPTS OF INDUSTRY

Vickers assigns four

Albert W. Agnew has been appointed branch operations manager of the Machinery Hydraulics Div., Vickers, Inc. His office will be in Detroit. He was manager of the firm's Los Angeles area branch. As application engineer for industrial hydraulic products, William P. Hunt has been transferred to Vickers' Pittsburgh office. He did application engineering work in the Detroit area.

Agnew

Hunt

Philip A. Kubik has been promoted to district sales manager, Cleveland office. He will handle Vickers mobile equipment. He joined Vickers in 1953, and came to the Cleveland office in 1956.

Kubik

Freitag

He was an application engineer, mobile products. The company has opened a mobile equipment sales office in Portland, Oregon. Walter H. Freitag has joined the Portland sales staff.

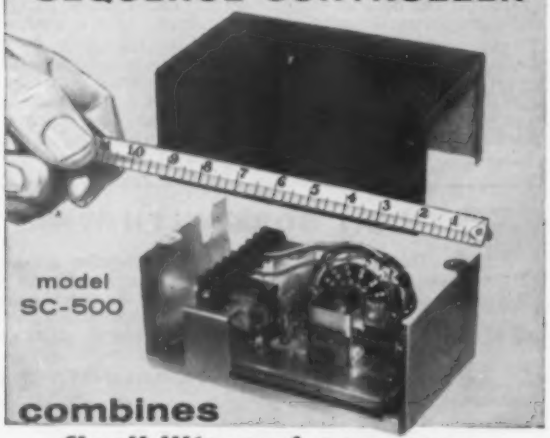
Cascade builds plant in Springfield, Ohio

Cascade Mfg. Co., Portland, Oregon, has begun production in its new, 25,000-sq. ft. plant in Springfield, Ohio. Construction was finished in November, and the first shipment went out the

NEW!

WARCO

SEQUENCE CONTROLLER



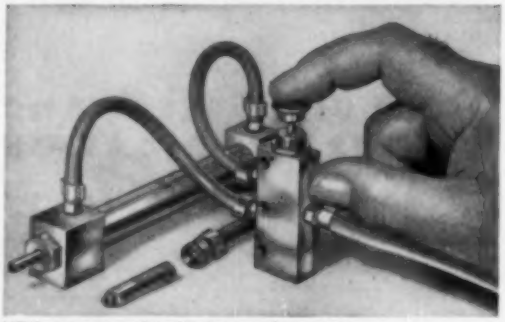
flexibility and economy

Announcing a new electrically operated control device with unusual flexibility. Switches from 2 to 12 circuits in any predetermined sequence. Almost infinite number of sequences and sequence combinations possible. Costs less initially . . . inexpensive to install and operate. Get all the facts and specifications, including detail drawings. Write for SC-500 literature today!

WARCO Industries, INC.
6625 Delmar Blvd. • St. Louis 30, Mo.

Circle **128** on Time-Saver Card

NEW! MORE Powerful 9/16" MINIATURE AIR CYLINDERS · 4-WAY AIR VALVES · QUICK CONNECTS



NEW more powerful 9/16" bore spring return and double acting MINIATURE Air Cylinders to complement our widely used ⅜" bore cylinders. NEW 4-way Air Valve, Quick Connects, A.C. and D.C. Valve Operating Solenoids, NEW MINIATURE Flow Control, Needle and Check Valves, fittings, mountings and accessories to improve your automatic production and tooling devices or new end products where savings in cost, weight or space are MUSTS. Made for MILLIONS of cycles of trouble-free operation. Attractively priced.

Write for NEW Bulletin No. 459

Clippard INSTRUMENT LABORATORY, INC.
7386 Colerain Rd., Cincinnati 39, O. • Phone: JA 1-4261
Manufacturers of R. F. Coils, Electronic Equipment, Miniature Pneumatic Devices

Circle **137** on Time-Saver Card

next month. During this first year, the plant will concentrate on hydraulic cylinders. Jack R. Hagen, formerly sales manager at Portland, is plant manager. Sales and general offices remain in Portland.

Standard Tube promotes Hintz

P. C. Hintz is vice president of sales for The Standard Tube Co., Detroit, Mich. For the past seven years, he represented Standard in the Buffalo area.

Sanders elects Rowen v. pres., manufacturing

George Rowen has taken the new post of vice president of manufacturing of Sanders Associates, Inc., Nashua, N. H. Before the appointment, he was with Sparton Corp., Jackson, Michigan, for 23 years. In 1956 he was chosen vice president and general manager of the Sparton Electronics Division and, last year, he moved up to a corporate vice presidency.

Damer, Merrell advance at Spotton

Andy Damer and Ralph Merrell have been made directors of John Spotton Co. Ltd., Toronto, Ontario, Canada. Damer, head of sales, has become vice president. Merrell, secretary-treasurer, is in charge of office and warehouse.

Damer

van Dyck

van Dyck promoted to sales manager

Laurens C. van Dyck is now sales manager of Greene, Tweed & Co., North Wales, Pa. He was a district sales representative in Michigan and western Ohio. van Dyck has been in the packings industry for 25 years.

Continued on next page

Specify an Adams Aftercooler for Maximum Compressed Air Efficiency

When you design your compressed air system, be sure all of the components are specifically engineered to do their job most effectively. An Adams Aftercooler and Cyclone Separator is specifically engineered to achieve maximum operating efficiency — backed by more than 25 years experience.

Adams design offers you all the extras to insure peak performance throughout its operating range. 10° cooling is "standard" to assure optimum water and oil removal required for most applications. For more complete removal, 2° cooling is also available.

The exclusive Adams Cyclone Separator design assures you complete removal of the condensed liquid at any through-put up to design capacity, assuring you maximum separation for your cooling water dollar . . . and cleaner, drier air.

Many mechanical design extras are standard with Adams. The floating tube sheet is machined after the tubes are rolled—for longer packing life. Packing gland strain is eliminated by externally supporting the floating tube sheet. Mass production makes these "service saving" features available at no premium in price. Thus, trouble free air is yours at minimum equipment cost.

Why not realize all the advantages of a unit specifically designed to do its job best. Write today for the complete story — ask for Bulletin 714.

R. P. ADAMS CO., INC.

249 East Park Drive, Buffalo 17, New York

Circle **2** on Time-Saver Card

"Off the Shelf" HYDRAULIC EQUIPMENT

in capacities from 8 to 25 gallons... up to 1000-1500 psi

Engineered by the world's largest manufacturer of hydraulic jacks, Hein-Werner pumps, motors and valves offer compact, high precision, light weight, balanced design. *Valves offer*: large oil passages, close grained high tensile body castings, spring centered ball detent hold, pressure relief valve and hardened seat INSERT for long life. *Motors and Pumps* feature forced lubrication and internal bleeding for axial balance and to eliminate high pressures against oil seals; rotation in either direction, heavy duty roller bearings and gear type constant displacement.

FOX RIVER MFG. CO.
A DIVISION OF

Hein-Werner CORPORATION

OSHKOSH 4, WISCONSIN 5014

Circle **44** on Time-Saver Card

NEW

BUDGET PRICED

HYDRAULIC "AUTOMATION" "HI-LO" PRESSURE **PUMPING UNITS**

DPR-21-1500

DPU-5-3000

DPU-15.5-1500

Above Pumping Units give total volume of both pumps until cut-out pressure of the large volume-low pressure pump reaches the maximum setting of the unloading valve. The low volume-high pressure pump takes-over until maximum setting of unloader or relief valve on high pres. circuit is reached.

(1) No. DPR-21-1500 – A 21 GPM PUMPING UNIT and RESERVOIR

An ideal unit for any application where a fast approach to work load is needed. Delivers 21 GPM at 1500 PSI with a 5 HP, 220/440 V., 3-phase, 60 cycle AC motor. Has 17 GPM large volume, low pressure pump which can be set to unload from 50 to 450 PSI. Also a 4 GPM low volume, high pressure pump which can be adusted to 2000 PSI. As shown mounted on 31 gallon reservoir (available w/o reservoir) **625.00**

(2) 5 GPM – 3000 PSI PUMP UNIT

Has a 3 HP, 220/440 V., 3-phase, 60 cycle AC motor. The large volume, low-pressure pump is a variable displacement type. Has 3-1/2 GPM volume and automatically unloads at 600 PSI. The low volume, high pressure pump delivers 1-1/2 GPM at 3000 PSI. Fixed displacement type. Pressure must be controlled by external relief or unloading valve.
No. DPU-5-3000 as shown . . 310.00

Same as above but mounted on a 18 gallon reservoir **535.00**

(3) 15-1/2 GPM – 1500 PSI PUMP UNIT

Has 3 HP, 220/440 V., 3-phase, 60 cycle AC motor. Large volume, low-pressure pump delivers 14 GPM up to 300 PSI. A fixed displacement type. External unloading valve must be used. The low volume, high pressure pump delivers 1-1/2 GPM at 1500 PSI. Fixed displacement. Unloading or relief valve must be used to control the pressure.
No. DPU-15.5-1500 as shown . . 249.50

Same as above but mounted on an 18 gallon reservoir **525.00**

SPECIAL 25 GPM PESCO PUMP

A special Palley Government Surplus Value. Positive Displacement type. Delivers 25 GPM at 3450 RPM. Pressure limit is 500 PSI continuous or 1000 PSI intermittent. Cat. No. H-P25SU Without pump mount. ONLY **27.95**

PUMP MOUNT – As shown on pump above. Has sealed-in bearings and 4-hole foot mount . . . . . **Only 16.95**

WEBSTER HYDRAULIC POWER DRIVE

Designed for U.S. Navy to remotely elevate large guns. Has 3500 RPM, 5 HP (intermittent), 3HP (continuous), 220–440 Volt, 60 cycle, 3-phase motor. The motor hooked to a Vickers heavy duty, variable volume reversible pump – No. P-V 2003-S108. Pump delivers approx. 7 GPM. Also included is elect. controls

Originally cost approx. $2000 **$195**

WOOSTER – 4500 RPM DYNAMOMETER TEST STAND

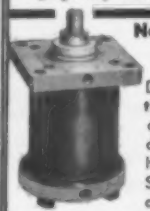
To check Torque on pumps, fluid motors, generators, etc. Complete with 10 HP, 1725 RPM, 220/440 V AC, 3-phase, 60 cycle motor. Motor drives a 5 KW, DC Generator to supply current for a 5 HP, DC Variable speed motor. Stand has a torque scale and tachometer. Comes with complete power panel; a Rockwell 20 GPM rotary flow meter; an 85 GPM, 3,000 BTU Ross heat exchanger and a large volume Cuno Air Filter. NOW.. **$1475**

HYDRAULIC TEST STAND BARGAINS

A GREER Test Stand. Capacity of 20 GPM at 5000 PSI with a 60 HP, 220/440 V., 3-phase AC motor. Complete with a Denison 700 series, variable displacement pump. Console stand is 7 ft. high x 12 ft. long. . . . . **NOW ONLY $4500.00**

HYDRAULIC TEST STAND – With 30 HP, 220/440 V., 3-phase AC motor. Delivers 20 GPM at 3000 PSI. Has a Vickers variable displacement pump. A Surplus Bargain **$2500.00**

New Hydraulic Cylinders



Designed to meet the most rigid requirements of industry. All are heavy duty steel. Shown here are 2 of our line.

Available in heavy duty press type cylinders of 3", 5", 6" and 8" bores – thrust up to 75 tons. Also in internal cap types as at right above – with up to 4" bore and up to 18,850 lbs. of thrust at 1500 PSI. Write for complete list of Special Palco Hydraulic Cylinders.

palley/s

2263 E. VERNON AVE., DEPT. AH-40
LOS ANGELES 58, CALIF.

TO ORDER: Send Check or M.O. – 1/2 deposit with C.O.D.s. Prices F.O.B. Los Angeles. All items shipped freight or postage collect.

Circle **94** on Time-Saver Card

POST SCRIPTS OF INDUSTRY

Hart and Pike get Dollinger posts

Dollinger Corp., Rochester, N. Y., has promoted John J. Hart

Hart

Pike

to chief engineer. He has been with the firm since 1952. Replacing him as research director is E. Grant Pike. He was with du Pont, and Pittsburgh Coke & Chemical before joining Dollinger.

New firm to make fluid power equipment

A new corporation, Fluid Power Ltd., has bought the plant and rights to make and market the engineering products of Viceroy Mfg. Co. Ltd. President of the new Toronto firm is Harold J. A. Chambers, management consultant and engineer. T. H. Beard is chief engineer. B. S. Male heads sales. Products include hydraulic and pneumatic cylinders and equipment, hydraulic machinery, and aircraft components.

Consulting office opens in Nashua, N.H.

Thomas W. Thompson recently opened his consulting engineering office in Nashua, N. H. He offers design and development service in mechanical, hydraulic, and electronic control systems. He was engineering section head at Sanders Associates. He was responsible for the development of electrohydraulic servomechanisms.

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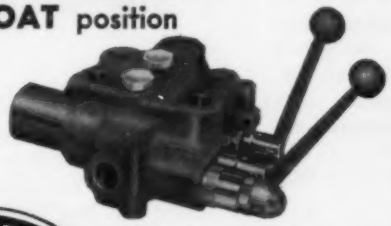
DIRECTIONAL CONTROL

with **FLOAT** position

MODEL WPK



GRESEN HYDRAULICS

NEW 2-spool parallel valve for snow plows, dozers, loaders, graders and similar mobile equipment.

FIRST SPOOL has four (power-neutral-power-FLOAT) positions. It is spring loaded to neutral, but has a detent in the FLOAT position.

SECOND SPOOL is conventional 3-way or 4-way as required, spring loaded to neutral.

BOTH SPOOLS have separate ball checks—are self centering, fully balanced and accurately feathered for fine metering action.

RELIEF VALVE is cartridge type with hardened seat.

TRIPOD MOUNTING feet make installation easy.

CAPACITY—40 GPM at 20 ft./sec.

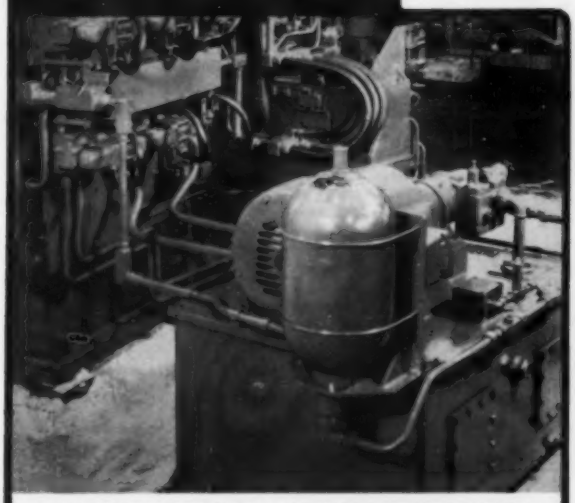
MAX PRESSURE—1500 psi.

WRITE FOR LITERATURE

GRESEN *Mfg. Co.*

405 35th Ave., N.E., Minneapolis 18, Minn.

APPLICATION ENGINEER'S FILE NO. P261



ACCUMULATORS TO HOLD PRESSURE

Band Saw Milling Machines made by Fitchburg Engineering Company incorporate a 2½ gallon Greer hydro-pneumatic bladder-type accumulator in the clamping circuit to hold hydraulic pressure and improve operation. Here as in numerous other applications Greer accumulators are specified to obtain maximum reliability and longer trouble-free operation. On your next fluid system design problem, be sure to contact a Greer factory representative or your local Greer distributor.

GREER HYDRAULICS INC.

4474 East Olympic Boulevard, Los Angeles 23, California

496 Grand Blvd., Westbury, L.I., N.Y.

Circle **50** on Time-Saver Card

MINIATURE SOLENOID VALVES

• Small Size: (1½"x2¾") • Large Capacity

• Packless—only 2 moving parts

Available in 2- and 3-way normally open and closed types, this new line of solenoid valves has a pressure range from 0 to 400 psi. Bodies can be supplied in stainless steel, brass and aluminum.

NEW FEATURES:

• Operating temperature of +110° C to −65° C—higher temperature requirements can be supplied on special order.

• Many modifications are possible including side, bottom and top metering (3-way and 2-way normally open).

• Several models are U. L. Approved.

• New Type "S" valve designed for completely noiseless operation.

FOR MORE INFORMATION WRITE FOR BULLETIN V.

ALLIED CONTROL VALVE DIVISION

ALLIED CONTROL COMPANY, INC.

2 EAST END AVENUE, NEW YORK 21, N. Y.

AL-197

Circle **9** on Time-Saver Card

POST SCRIPTS OF INDUSTRY

New distributors

Air Valves Co., Warren, Mich., has named *Robert J. Garnik Co., Brookfield, Wis.*, for Wisconsin and Upper Michigan. *Southwestern Controls, Houston and Dallas, Texas*, will cover Texas. *H. B. Parke Co., Pittsburgh, Pa.*, will take western Pennsylvania and West Virginia. *Valley Engineers, Glendale, Calif.*, has the Southern California territory. *Shively Brothers, Inc., Flint, Mich.*, will represent Air Valves in central Michigan; *C. H. Berry Co., Grand Rapids, Mich.*, in western Michigan.

Blumberg Supply Corp., Hempstead, L. I., N. Y., Chicago, Ill., and Culver City, Calif., will distribute plastic caps, plugs, and protective closures for S. S. White Co., Plastics Div.

Ellis Akin Engineering Co., Kansas City, Mo., and *Keller Industrial Products, Inc., Rochester, N. Y.*, will distribute Crown compressed air components made by Hannifin Co. Div., Parker-Hannifin Corp., Des Plaines, Ill. *Marvin A. Heeren & Co., Moline, Ill.*, will distribute hydraulic check valves and general-purpose, single-spool lever control valves made by Parker Hydraulics Div., Cleveland, Ohio.

J. R. Simpson Co., Maywood, Ill., will distribute for Hoke, Inc., Creskill, N. J. Simpson territory includes northern Illinois, southern Wisconsin, and northwest Indiana.

High Pressure Equipment Co., Inc., Erie, Pa., will distribute test equipment for Barnet Instruments Ltd., Hertfordshire, England. Products include deadweight testers, pressure converters, and comparison test pumps.

James Engineering & Machinery Co., Dearborn, Mich., will represent Almo Manifold & Tool Co., Centerline, Mich., in southeast Michigan.

J. Royal Co., Inc., Barrington, R. I., will handle mechanical packings and seals of Linear, Inc., Philadelphia, Pa. Royal will cover the Boston-Providence area, Maine, and New Hampshire. *Kiva Sales Co., Phoenix, Arizona*, will distribute for Linear. *Elastolines, Inc., Newington, Conn.*, will cover New Haven and Hartford, Conn., and Springfield, Mass. *Haskel Seals Div., Haskel Engineering & Supply Co.*, Linear's California distributor, will establish Linear distributors in eleven Far West states.

The Kennett Corp., Brookline, Mass., will take New England for Dragon Engineering Co., Inc., Norwalk, Calif. Kennett will distribute high pressure needle valves and fittings.

AUTO-PONENT®
HYDRAULIC
FULL FLOW VALVES
Flow Control, Needle, Check, for HYDRAULIC Power
Model KF Flow Control Valve with Dial and Knob adjustment for direct reading and duplicating reference. Now available in Aluminum for 3000 psi
Pat. #2,841, 174

A complete line: 1/8", 1/4", 3/8", 1/2", and 3/4" female Dryseal Pipe Sizes in all models and types. Equivalent Aeronautical Tube Sizes on special order.
MINIMUM PRESSURE DROP AND POWER LOSS . . . Oversize ports and passages give maximum flow at minimum pressure drop, insure greater accuracy and response in hydraulic or large volume air cylinder control.
EASY FLOW ADJUSTMENTS under full pressure. Seal located at port to eliminate air or dirt traps. Gland structure equally effective on pressure or vacuum.
SENSITIVE, CHATTERLESS BALL CHECK . . . Patented design insures rapid ball movement to open or close at low differentials.
FORGED BODIES permit higher pressures with wide safety margins. Aluminum—3000 psi; Steel and Stainless Steel—5,000 psi. Pressure ratings based on better than 5 to 1 safety factor. All internal parts are Stainless. Write for illustrated catalog.

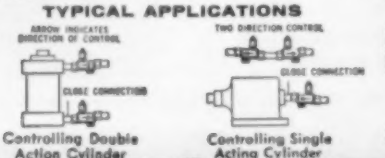
Model F Standard Flow Control Valve or Model N Needle Valve

Model KF Knob and Dial Flow Control Valve or Model KN Needle Valve.

Model PF Knob and Dial Flow Control Valve or Model PN Needle Valve for panel mounting.

Model C Check Valve for In-Line Mounting.

TYPICAL APPLICATIONS



Controlling Double Action Cylinder
Controlling Single Acting Cylinder

AUTOMATION AUTO-PONENTS INC. COMPONENT
2919 GRANT STREET
BELLWOOD (Chicago Suburb) ILLINOIS

Circle 17 on Time-Saver Card

REPRINTS

The following reprints of special reports which have appeared in APPLIED HYDRAULICS & PNEUMATICS Magazine are available:

TEMPERATURE CONTROL IN HYDRAULIC SYSTEMS

A complete report on latest developments. Sixteen pages of data on heat generation, fluids and packings, heat dissipation, system design, oil coolers, immersion heaters, and automatic temperature control.

COMPONENTS FOR WATER HYDRAULICS

A special 16-page report covering the design, selection and sizing of pumps, valves, accumulators, packings and cylinders. The report covers also additives and air controls.

WHAT TO LOOK FOR IN AIR VALVES

This 16-page report contains basic designs of directional control, pressure control and flow control valves. Illustrates many different designs and points to remember in selecting a specific design.

Single copies 50¢; over 50 copies, 35¢ ea.

REVISED JIC HYDRAULIC STANDARDS

Single copy	**75c**
10 to 24 copies	**60c**
25 to 49 copies	**50c**
50 or more copies	**40c**

Send all orders—enclosing the exact amount in coins or checks—to: APPLIED HYDRAULICS & PNEUMATICS, 812 Huron Road, Cleveland 15, Ohio.

MARKET PLACE

When replying to a box number in the Market Place, address your letter to Applied Hydraulics & Pneumatics, 812 Huron Road, Cleveland 15, Ohio. Attention: Box No.

RESEARCH OPPORTUNITY

Are you a Graduate Engineer or have similar training? Are you experienced in Hydraulic Component or Circuit Design, or in related Mechanical and Electronic Fields? Are you interested in Project Engineering Responsibilities? Would you like to work without Product Continuity Problems? Are you interested in new Basic Engineering Problems? Would you like to work in the Midwest for a small non-profit research organization with a complete model shop and testing laboratory? If you can answer yes to these questions, it will pay you to write to Box 4160, APPLIED HYDRAULICS & PNEUMATICS.

SALES ENGINEER WANTED

Leading West Coast Distributor of fluid power components wants proven Sales Engineer to cover Industrial, Mobile Equipment, and GSE market in Southern California. Mail complete resume direct to The Sweetland Company 5403 Sheila St., Los Angeles 22, California; Attn: Walter Gaines District Mgr.

ENGINEER-EDITOR

Do you have a basic engineering knowledge? Can you think and write clearly about technical subjects? Would you enjoy a position with variety, challenge, potential?

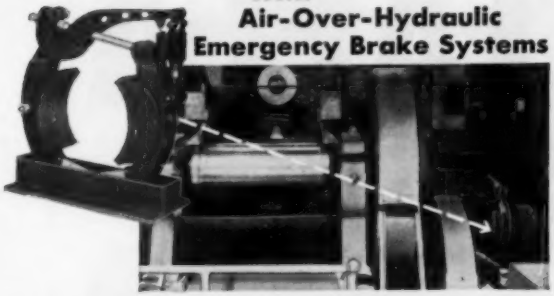
If your answer is *yes*, we'd like to discuss an opening on our editorial staff. Send your resume to:

APPLIED HYDRAULICS & PNEUMATICS
812 Huron Rd. Cleveland 15, Ohio

Classified Advertising Rates: Cost of Position Wanted ad is $10.00 for the first inch, each additional line 90 cents. Cost of all other classified ads is $20.00 for the first inch and $15.00 for each additional inch or fraction thereof. Rates for Display Ads in this section will be sent on request.

Circle **127** on Time-Saver Card

STOP "INRUNNING ROLLS" SAFELY
With Air-Over-Hydraulic Emergency Brake Systems



Wagner A/H Emergency Brake Systems protect the operator (as required by safety codes) against the extreme hazards involved in operating machinery with inrunning rolls. An industrial-type brake is applied by an air-operated hydraulic power cluster to stop rolls quickly, smoothly, and with minimum strain on the drive. Systems incorporate safety devices to meet other emergencies, such as loss of air pressure or failure of power supply.

Brake assemblies are ruggedly constructed, are easy to install . . . require no special motor starters or control, no direct current. Maintenance is minimized . . . there is practically no lining wear, no heavy solenoid coils to burn out.

Apply these systems to your rubber or plastic mills, refiners, washers, crackers. Available with 6, 8, 10, 14, or 18 inch diameter brakes. Your nearby Wagner Sales Engineer has the complete story. Call him, soon.

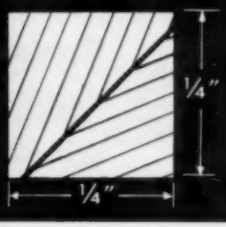
W160-3

Wagner Electric Corporation
6387 PLYMOUTH AVE., ST. LOUIS 33, MO., U.S.A.

PISTON LEAKAGE PROBLEMS ? ? ? CHANGE TO "STEP SEAL RINGS"

See the newest revolution in sealing rings by AUTO-DIESEL PISTON RING CO. The "STEP SEAL RING" has a sealing action over the entire area. This results in a ring that allows only ⅛ the leakage under 15 times the pressure of a straight cut ring—see comparison table below.

CROSS SECTION OF "STEP SEAL" JOINT



COMPARISON TABLE

STRAIGHT CUT COMPRESSION RING	"STEP SEAL RING"
With .005" end clearance has leakage rate of 150cc/min. at 400 lbs. pressure.	With .010"-.020" and .030" has a leakage rate of only 25cc/min. at 6000 lbs. pressure.

To reduce leakage to a minimum specify "STEP SEAL RING"

For complete details write for Bulletin H-57

THE AUTO-DIESEL PISTON RING CO.
3141 Superior Avenue • Cleveland 14, Ohio

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Circle **29** on Time-Saver Card

STAFFA

HIGH TORQUE VARIABLE SPEED (1-100 r.p.m.) HYDRAULIC MOTORS

Mark IV—5 cylinder 4,500 lbs. ft. at 2,000 p.s.i. (Speed 1-100 R.P.M.) **Mark V**—7 cylinder 6,600 lbs. ft. at 2,000 p.s.i. (Speed 1-75 R.P.M.) Overall efficiency 90% to 95%.
Ideal drive for conveyors, rolling mills, cranes, tractors, drills and most mechanical handling applications.
Ask for details of hydraulic cylinders, valves, pumps and motors.

CHAMBERLAIN INDUSTRIES LTD

Staffa Works, Argall Ave., Leyton, London, E.10, England.
Leytonstone 3678
(Member of the Chamberlain Group of Companies)

Kep-O-seal®

RUGGED! DEPENDABLE! CHECK VALVES with the **Flexible Seal Seat***

- LEAK TIGHT! BUBBLE TIGHT!
- SURGE PROTECTED!
- FLOW—STRAIGHT THROUGH!
- LONG LIFE! EASY CLEANING!
- SIMPLE AND TROUBLE FREE!

The sturdy Kep-O-seal check valve can really take hard service. Conservatively rated, it absorbs severe shock from either direction and always holds its seal. *REMAINS LEAK TIGHT!* Has been proved outstanding in everything from machine tools to missiles! Investigate and see for yourself! Write for full details.

*Patent Applied For

KEPNER

KEPNER PRODUCTS COMPANY
7321 West 59th Street • Summit, Illinois

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